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16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 4918 - 6272.

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NAPCA

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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U. S. Department of Health, Education, and Welfare
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TABLE OF CONTENTS

Scope notes for each category are given as a guide to our readers.

page

EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc. 1

CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants from the air. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry--e.g., automobiles. 21

MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development, testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories. 111

AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories. 155

page

ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere. Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions fall under Basic Sciences and Technologies. 167

BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes atmospheric photochemical studies and biochemical studies related to effects of air pollution. 181

EFFECTS-HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments. 277

EFFECTS–PLANTS AND LIVESTOCK

Effects on vegetation--crops, trees, other plants--and on livestock as distinguished from laboratory experimental animals. 301

EFFECTS–MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures. 311

ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general. 317

STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels. 319

page

LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions. 325

SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes, public opinion studies, public relations, and public information. 337

GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories. 339

SUBJECT INDEX..... 347

AUTHOR INDEX..... 361

ORDER FORM.....

4918 APTIC NUMBER 18935

Akagi, Mitsuru, Minoru Tsukahara, and Masakazu Okai
STUDIES OF ENGINE EXHAUST GAS ON AIR POLLUTION. 1. EXPERIMENTAL STUDIES OF DIESEL EXHAUST SMOKE. (Taiki osen genbutsushitsu to shiteno kikan haiki no kenkyu (I) Jiizeru kikan haikien no jikkenteki kenkyu). Text in Japanese. Mem. Fac. Eng., Yamagawa Univ., no. 1:65-75, 1967. 7 refs.

The soot produced in diesel exhaust is undesirable and a pollutant. The mechanism that produces soot has not yet been thoroughly examined, but concentrated soot is related to the fuel quality and operating condition of the engine. There is no universally acceptable commercial smokemeter, but meters are available for specific applications. The character of a smokemeter was studied, theoretically and experimentally. Density of soot in the exhaust gas was found to depend on the air-fuel ratio, output, and cooling-water temperature of the diesel engine. The form of the soot grain was also examined with an electron microscope. (Author summary modified)

4919 APTIC NUMBER 15186

Balazs, Zoltan and Andras Juhasz
EXAMINATION OF THE SULFUR CONTENTS OF THE BORSOD-BASIN BROWN COALS. (A borsodi barnaszenek kentartalmanak vizsgalata). Text in Hungarian. Banyasz. Tapok, 102(6):408-418, June 1969. 9 refs.

Based on 8961 analyses, the average sulfur content of 'Borsod' coals was found to be 2.6%; the upper and lower limits were 0.5% and 3.5%; 307 petrographical investigations showed that two-thirds of the sulfur is in globulites thought to be of bacterial origin. Calculated on the basis of the 307 microscopic preparations, the sulfur content averaged 3.51% (between 0.8% and 5.1%). Based on the analysis of 2079 samples, the iso-sulfur lines of the five coal fields of the Borsod Basin are shown on five maps in connection with the caloric value of the individual areas. The heat value of the basin is below 3600 kcal/kg. As the heating value increases from 0 to 3600 kcal/kg, the sulfur content increases from approximately 0.7% to 2.7%; the steepest increase in sulfur content (0.087%/100 kcal/kg) occurs between 200 and 2000 kcal/kg and the smallest increase (0.029%/100 kcal/kg) between 2000 and 2900 kcal/kg. A theory is presented to explain the correlation between the high heating value of the coal and the increase in sulfur content.

4920 APTIC NUMBER 18799

Barnea, N.
AIR POLLUTION CAUSED BY IRON AND STEEL MANUFACTURING. (Impurificarea aerului atmosferic produsa de industria siderurgica). Text in Rumanian. Igiena (Bucharest), 16(12): 741-746, 1967. 10 refs.

The industrial complexes of Hunedoara and Resita were studied over a ten-year period by the Bucharest Institute of Health, while the complex of Timisoara was studied by the local board of health. Hunedoara, while producing more tonnage of metal than Resita, has a smaller air pollution problem due to better movement of air. The city of Deva, however, has a lower incidence of respiratory, ophthalmic, and rachitic illnesses. Timisoara has both higher production and greater air pollution, with over 50% of samples collected containing above-normal content of SO2, although not above 0.50 mg/cu m. Pollution particles also filter out 3/8 of the city's solar radiation. Improvement of existing conditions and provision for future industrial expansion depend on improving efficiency of purification systems, whose cost is often prohibitive, and more careful urban planning.

4921 APTIC NUMBER 15392

Bean, Samuel L. and Howard Wall, Jr.
ATMOSPHERIC EMISSIONS FROM HYDROCHLORIC ACID MANUFACTURING PROCESSES. Public Health Service, Durham, N. C., National Air Pollution Control Administration and Manufacturing Chemists Association, Washington, D. C., Pub. AP-54, 59p. Sept. 1969. 15 refs.

The basic characteristics of the manufacture of hydrochloric acid are presented, including growth rate of the industry, manufacturing processes, product uses, and the number of producing plants in the United States. The Mannheim, Hargreaves, and Laury processes are discussed with respect to their historical interest, even though the number of plants that use them is decreasing. The concentration of hydrogen chloride emitted to the atmosphere is usually less than 0.5% of the tail gas volume emitted to the atmosphere. Emissions from hydrochloric acid plants are adversely affected by high temperatures in the absorption system, improper balance of absorption area and contact time, faulty equipment, and inadequate tail gas scrubbing systems. No correlation exists between exit gas volumes and plant production rates because of the diverse methods of production. However, smaller volumes of exit gas usually show greater hydrogen chloride concentrations due to the varying amounts of inert materials in this gas stream. Thus, the amount of hydrogen chloride emitted in pounds per ton of acid produced gives a more accurate description of the contaminant emissions. The hydrogen chloride emissions are usually reduced by scrubbing in a packed tower located behind the process tower. Water scrubbers can reduce the concentration to less than 0.1 pound per ton of acid produced. Hydrogen chloride absorption systems include falling film and adiabatic absorbers. Other contaminants such as chloride, chlorinated organic compounds and other hydrocarbons emitted to the atmosphere are mentioned.

4922 APTIC NUMBER 18809

Beveridge, G. S. G. and C. A. MacArthur
SULPHUR EMISSION TO THE ATMOSPHERE. Chem. Engr. (London), 87(6):304-305, July-Aug. 1969. 7 refs.

The sources of sulfur emission in Great Britain are discussed. Sulfur pollutants are essentially derived from conversion processes of the chemical industry, including cement manufacture, metal ore treatment, and smelting, and also from industrial and domestic energy conversion systems. Two examples of sulfuric acid production and the production of electricity from coal and oil are considered as representatives of the main large-scale sulfur sources. Apart from other industrial boiler installations and domestic users, who are also significant contributors, the sulfur pollution load from existing power generating stations is much greater than that from the chemical industry. Several processes are available for reducing or removing sulfur from oil, but only one-third of the refineries in England and Wales practice sulfur recovery to any extent. The present removal method is the desulfurization of fuel. If emissions from power stations were subject to the same rigorous scrutiny as those from chemical works, sulfur would have to be recovered at some stage. If the use of a low-sulfur source were a condition of fueling power station, low-sulfur oil might soon be available at competitive cost. The government could encourage this availability by exempting low-sulfur oil from part or all of the fuel oil surcharge. This would give some protection to the coal industry but would have the beneficial effect of reducing atmospheric pollution. It seems unreasonable to accept a high level of pollution from power plants when chemical and petroleum emission are limited by considerable capital expenditure.

8923 APTIC NUMBER 15282

Bhatti, W. W., L. J. Schermeister, and M. F. Koszalka
ATMOSPHERIC MOLD SPORE AND DUST PARTICLE SURVEY FOR NORTH DAKOTA AND NINE WESTERN COUNTIES OF MINNESOTA. Clovdia, 29(3):270-274, Sept. 1968. 8 refs.

In a survey made from June 1 to Aug. 1963, glass slides with a film of petroleum jelly were used to collect mold spores and suspended particulates at nine sampling stations in North Dakota and Minnesota. Spores included in the survey were Alternaria, Helminthosporium, and Hormodendrum. Other spores were also counted and categorized as miscellaneous. The particulate count included particles of plant, animal, or mineral origin. Results show that the area is subjected to the largest concentration of Alternaria spores reported in the United States. The incidence of Hormodendrum is also high. Although Helminthosporium shows the lowest maximum spore count, these spores appear in most samples analyzed. An outstanding feature of this survey was the wide distribution of miscellaneous particulates composed primarily of penicillium, rust, and smut. Major consideration should be given to these particulates as allergenic agents. Periodic increases in spore count coincide with periods of grain harvest or of high precipitation. Seasonal variations in the generally high particulate count in this area are influenced by wind, moisture, and temperature factors. A correlation was found to exist between the incidence of mold spores and 122 emphysema cases in a Veteran's Administration hospital. Evidence was insufficient to establish a correlation between mold spore exposure and incidence of asthma in 89 patients.

8924 APTIC NUMBER 14460

Bier, K. C., J. J. Frankowski, and D. K. Conyou
A STUDY OF FACTORS AFFECTING CARBURETOR PERFORMANCE AT LOW AIR FLOWS. Preprint, Society of Automotive Engineers, Inc., New York, Np., 1969. 2 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690137.)

Carburetor repeatability at idle was investigated both on the carburetor precision flow stand and on a chassis dynamometer equipped with exhaust emission test equipment. It was determined that some factors which significantly affect idle fuel flow repeatability on the carburetor test stand are surface roughness of mating parts in the fuel bowl inlet system, inlet valve eccentricity, and hydraulic shock in the fuel supply circuit. In addition, vehicle testing demonstrated that carbon monoxide changes at idle may occur with constant fuel-air ratio due to changes in fuel temperature. Cycle tests also showed a relationship between fuel temperature and carbon monoxide levels. Significantly, relatively modest variations in fuel temperature resulted in substantial variations in CO concentration under normal engine operating conditions. (Author abstract modified)

8925 APTIC NUMBER 14888

Blokker, P. C.
DISPERSION OF CHIMNEY FUMES. (Dispersion des gaz de fumee sortant des cheminees). Text in French. Pollut. Atmos. (Paris), 11(Special):9-19, Feb. 1969. 27 refs.

Movement of smoke is calculated in two phases: that of ascent to its maximum height, i.e., the theoretical chimney height, and then dispersion and diffusion in the wind. With regard to dispersion, if vertical sections of the plume exhibit Gaussian concentration distributions, then, in average meteorological conditions, the ratio of vertical to horizontal mean dispersions at each distance from the chimney is thought to be independent of that distance (Sutton's theory). Then, the maximum concentration produced on the ground depends on the dispersions only with respect to their ratio. According to theory and experiment, the ratio goes from about 1 to 0.5 as at times go from 3 min to 8 hrs. The CONCAWE foundation (Conservation of Clean Air and Water in Western Europe), established in 1963 by six large oil companies, proposed a formula for the theoretical chimney height which states that it is directly proportional to the square root of heat output and inversely proportional to the three-fourths power of wind speed. The formula is based on observations of sources emitting below 8000 kcal/sec. Ninety per cent of the observations lie within plus or minus 50% of the value given by this formula. Using this height in Sutton's formula and knowing the chimney height, the maximum ground concentration can be found. The height recommended by CONCAWE is obtained by using a ratio of vertical to horizontal dispersions of 0.7. Comparison with the association of German Engineers and British Alkali Inspectorate results shows the CONCAWE determination to be lower for emissions near 20 N cu m/sec. However, this determination compared well with Russian work for 100 N cu m/sec gas emissions.

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8926 APTIC NUMBER 14701

Bretschneider, B.
MAIN SOURCES OF INDUSTRIAL GASEOUS EMISSIONS. (Hlavni zdroje prumyslovych plynnych exhalacii). Text in Czech. Ochrana Ovzdusi, no. 7:26-30, 1969. 29 refs.

Sulfur dioxide is the most harmful gaseous emission in Czechoslovakia. The primary source of sulfur dioxide emission, which reached approximately 25 million tons in 1966, are power engineering, e.g., powerhouses, boiler houses, heat plants, etc., surface mining of sub-bituminous coal in Northern Bohemia, and domestic fireplaces. The latter are particularly important sources of pollution in residential and urban areas. Powerhouses of the Central Board of Power Engineering emit as much sulfur dioxide as the powerhouses and boiler houses of industrial plants. Their emissions contaminate the lower atmosphere of whole areas. Air quality in the CSSR, especially in Northern Bohemia and around industrial complexes, can be raised by controlling the diffusion of sulfur dioxide and combustion products in the lower atmosphere. Less important sources of gaseous emissions are metallurgical engineering plants, which produce both sulfur dioxide and monosulfide, and chemical works whose emissions, though low, can be extremely harmful. Emissions from powerhouses of industrial plants are of local importance.

8927 APTIC NUMBER 15668

Capetti, Elena, V. G. Popescu, T. Gheorghiu, I. Dobre, and C. Mastase
CONTRIBUTION TO THE STUDY OF ATMOSPHERIC POLLEN AND MOLDS IN CITIES R. AND G.R. (SOUTHERN CARPATHIAN MOUNTAIN VALLEY REGION OF ROMANIA). MOLDS. NOTE II. (Contribution a l'etude du pollen et des moisissures atmospheriques des villes de R. et de G.R. (Region sous-carpatique meridionale de la Roumanie). Moisissures. Note II). Text in French. Acta Allergol., 24(1):39-48, March 1969. 11 refs.

Dust, pollen, and mold play the most important role in allergy. Although mold allergy was discovered 35 years ago and a few articles were written, allergy to mold has never been estimated. Alternaria, Cladosporium, Helminthosporium, and Fusarium molds were collected and then plates covered with Calberla solution in a Durham apparatus and exposed to air at 2 m. Penicillium and Aspergillus molds were collected by exposing Czapek culture medium at 5, 15, and 25 m and placing them in a thermostat for 10 days at 25 C. The predominant molds found in both villages (Breaza and Govora-les-Bains) were Cladosporium, Alternaria, Penicillium, and Fusarium. The total number of spores was higher in Breaza. There was a close relationship between the amount of mold and the humidity and temperature. The colonies were most numerous in September. It was also noted that the colonies were more abundant at heights up to 5 m and in the afternoon as compared to the morning. It is difficult to establish the correlation between mold and the respiratory and skin allergies. It is possible, however, that certain allergies which cannot be explained by pollen are due to mold. Cladosporium and Alternaria were encountered most often, and these are well known for their allergenic potential.

8928 APTIC NUMBER 16619

Cejka, Milan
DIESEL ENGINE EXHAUST GASES. (Vyfukove plyny z naftovych motoru). Text in Czech. Rozp Uhlie, 9(6-7):208-211, 1967.

Composition of engine exhaust gases depends largely on the fuel-air ratio, which varies in accordance with the loading of the engine from 18:1 to 100:1, and this greatly influences the combustion process. In addition, the content of exhaust gases is determined by the shape of the combustion chamber, the type of fuel injection, whether the engine is two or four stroke, habits of the driver, etc. Analysis gave evidence of 47 different compounds in engine exhaust gas. Nitrogen oxides comprised 80-85% of the emissions from diesel engines compared to 10% from combustion engines. The content of aldehydes in smoke is the main cause of toxic effects in humans. It is believed that lighter fuels reduce smoke, but they yield more irritant compounds. In a garage for 200 buses whose engines were in good condition, the measured concentration of carcinogens was 2.7 to 2.9 micrograms/100 cu m, which is less than values found in ambient air from burning coal. The setting of maximum allowable concentration standards is very difficult because of the wide range of individual reactions to engine exhausts. Reduction of pollution may be effected by supplying specially treated fuel with low sulfur content, after burning of gases as practiced in the U. S., and regular inspection of engines.

8929 APTIC NUMBER 1886

Durrant, T.
TOWARDS CLEANER SKIES. Aeroplane, 116(2966):16, 20-21, Aug. 21, 1968.

The main contaminants produced by aircraft burning kerosene fuels are exhaust smoke, unburned hydrocarbons, carbon monoxide, and sulfur and nitrogen oxides. The presence of smoke in the engine exhaust is a failure to control carbon production or consumption processes or both, but experience has shown that elimination of smoke is difficult at increased engine pressure ratios. By changing combustion-chamber design and including airspray fuel injectors, it is expected that new large transport gas-turbine engines will have a barely visible level of smoke emission. Annular chambers now being introduced have a smaller flame tube wall surface area and therefore use less cooling air than the tuboannular system. Consequently, unburned hydrocarbon and carbon monoxide concentrations at idle and taxi conditions will be lower on new engines than on those currently in service. The most difficult contaminants to control are nitrogen oxides, although concentrations are low compared with the automobiles. Intensive investigations are being conducted to reduce these emissions; it is suggested that one method of reducing their concentration may be by running with a richer primary

combustion zone, although this is contrary to smoke-control requirements and would involve design compromises.

8930 APTIC NUMBER 15367

Eberan-Eberhorst, E.
PROBLEMS OF EXHAUST GASES FROM OTTO ENGINES - RESULTS OF OTHERS' AND ORIGINAL MEASUREMENTS. (Probleme der Abgase von Ottomotoren - Ergebnisse fremder und eigener Messungen). Text in German. ATZ (Automobiltechnische Zeitschrift) (Stuttgart), 70(2):80-85, 1968. 19 refs.

Tests of the Otto engine on a dynamometer showed that all carbon monoxide and hydrocarbons can be easily eliminated in the load and speed range of the engine. Only when the engine acts as a vehicle brake does the hydrocarbon (CH) content exceed 1000 ppm. Optimum spark timing and diminishing of the valve overlap reduces the idle rpm to 730 with a CH content of less than 1000 ppm. Above 1550 rpm, extremely high CH concentrations of more than 5000 ppm occurred. This phenomenon was studied in greater detail. For this purpose, the combustion pressure in the cylinder was induced, and PV diagrams were obtained with a piezo quartz pressure pick-off and a cathode ray oscillograph at 2000 rpm and slowly closing throttle valve. Initially the combustion was rather complete, as the emission concentrations of 0.15% CO by volume and CH less than 30 ppm, show. By further closing of the throttle valve, the pressure decreased from 8.0 to 0.28 kg force/sq cm, combustion became markedly irregular but still complete, and emissions decreased. At an underpressure of 898 mm Hg in the intake pipe, the engine began to act as a brake, but the emissions were still only 50 ppm CH. Upon closing of the throttle valve to 8 degrees, emissions increased to 8000 ppm CH. There are two ways to avoid high emission concentrations of CO and CH caused by misfiring; namely, by prevention of the development of toxic exhaust components in the engine, or by destroying the toxicants in the exhaust system. A review of the major methods developed by the various automobile manufacturers is given. In conclusion, a regulator is described which maintains a constant fuel supply and a constant underpressure in the intake pipe during all operating states.

8931 APTIC NUMBER 18816

Edison Electric Inst., New York, Electric Power Survey Committee
43RD SEMI-ANNUAL ELECTRIC POWER SURVEY. 52p., April 1968.

Results are given of a survey covering practically the entire electric utility industry of the country, including investor-owned systems, those of governmental agencies, and rural electric cooperatives. The survey also includes those industrial power installations whose operations are coordinated with the utility systems with which they are interconnected, and which thereby contribute to the public supply. It does not include any isolated industrial or institutional power installations. Survey results pertaining to power system capabilities, loads, gross margins, and energy outputs are presented for each of the eight power supply regions of the United States, as defined by the Federal Power Commission. Also presented are figures which represent the Total Electric Utility Industry of the contiguous United States, including those industrial installations contributing to the public supply. These values are based on the survey totals for the eight regions but incorporate upward adjustments to compensate for the minor omissions in survey coverage previously mentioned. No adjustments have been made to the survey totals for the individual regions. Data in this report pertaining to the manufacture, in the United States, of heavy power equipment for all classes of customers represent substantially all such manufacture in this country. December peak capabilities, peak loads, and gross margins as recorded for the years 1966 and 1967, and as now forecast for the years 1968 through 1973 on the basis of median hydro conditions, are given, as well as forecasts based on assumed adverse hydro conditions for December and Summer of 1968 through 1973. (Author introduction modified)

8932 APTIC NUMBER 15723

Faingold, S. G., A. F. Stanetskaya, L. A. Tretyakova, and N. S. Pipot
CAUSES OF THE FORMATION OF NITRIC OXIDE IN THE CARBONIZATION OF COALS. Coke Chem. (USSR) (English translation from Russian of Koks i Khim.), no. 2:23-28, 1969. 10 refs.

While confirming that nitric oxide is an inevitable product of coal carbonization, previous research has not established the extent to which carbonization participates in nitric oxide content of coke oven gas or its relationship to the nitrogen content of coal. To resolve these questions, as well as determine the nitric oxide content of coke-oven gas during carbonization, various coal blends and different grades of coal were carbonized in a gas-tight oven chamber at a pressure of 600-800 mm water gauge. The evolution of nitric oxide followed the same pattern for all blends and coals: the content reached a peak at 200-300 C, the beginning of carbonization, and the peak lasted until 800 C. The quantity of nitric oxide evolved was unrelated to the nitrogen content of the blends and coals. For example, one blend contained 2.36% nitrogen, and the dynamic mean nitric oxide content of the coke-oven gas equalled 2.83-3.67 ppm or 0.36-1.12 ml/kg for the blend. The nitrogen content of the blends ranged from 1.5-2.36%. The nitrogen content of coals varied less and the volatile matter differed sharply, but nitric oxide formation was the same as for blends. It is concluded that nitric oxide is formed as a result of reactions involving the liberation of oxygen from the air, introduced with the blend or coal and the oxygen-nitrogen-containing compounds in the coal.

8933 APTIC NUMBER 16759

Fraguenfelder, A.
WHAT WAS BEEN DONE BY THE SWISS CEMENT INDUSTRY TO ELIMINATE THE DUST PROBLEM IN THEIR DIFFERENT WORKS. (Was hat die schweizerische Zementindustrie fuer die Entstaubung ihrer Werke getan). Text in German. Zement-Kalk-Gips (Wiesbaden), 58(11):501-504, Nov. 1969. 4 refs.

There are only 18 cement works in Switzerland with relatively small capacities and only one kiln producing more than 1000 tons per day. Since 1950, this industry made great strides in air pollution control. The Swiss Association of Cement, Lime, and Gypsum Producers established their own rules for dust emissions in 1963 which were binding for members. Clean gases from new installations should not have more than 75-100 mg dust/cu m. Older plants have until 1973 to reduce their emissions to 100-150 mg dust/cu m. A federal law states that only plants which meet these requirements obtain approval from the Authorities of the Canton. In all cement works meeting the emission standards, adequate dust collection devices are in operation. The sources of dust in the cement works, adequate dust collection equipment, and costs were discussed. Equipment includes bag filters for dry dust and gases at low temperatures, electrical precipitators for the cleaning of waste gases from kilns, and raw material dryers. Installation difficulties from corrosion and methods for the correction of the problem were described. Multicyclones and gravel bed filters also have special applications in the dedusting of clinker coolers. It was concluded that many Swiss cement works are clean and by 1973, all cement works will meet emission standards. (Author summary modified)

4934 APTIC NUMBER 15310

Friedlander, S. K. and J. H. Seinfeld
A DYNAMIC MODEL OF PHOTOCHEMICAL SMOG. Environ. Sci. Technol., 3(11):1175-1181, Nov. 1969. 19 refs.

A simplified kinetic scheme is proposed as a dynamic model for photochemical smog reactions. Unlike previous diffusion models, which have been concerned with nonreacting pollutants, the formulation of this model takes into account both the chemical reaction and turbulent mixing aspects of the photochemical smog problem. In the first part of the paper, a simplified kinetic mechanism is presented for the formation of photochemical smog from nitric oxide and unburned hydrocarbons. In the second part, diffusion models based on the general equation of conservation of species are discussed. The model is a combination of the transport and chemical kinetic equations and predicts the behavior of a reacting pollutant cloud. The roles of sulfur oxides and aerosols are not considered. Calculations basedon the model lead to concentration dependence on time, similar in form to the experimental results for laboratory reaction chambers. The Lagrangian similarity hypothesis for the diffusion of nonreactive components is extended to reacting species to take into account the effect of atmospheric mixing. This leads to a set of ordinary differential equations for the reactive species of the type describing a chemical reactor of variable volume. As a preliminary example of the application of the model, a calculation was made for a single bimolecular reaction.

4935 APTIC NUMBER 10462

Gagliardi, J. C. and P. P. Ghannam
EFFECTS OF TETRAETHYL LEAD CONCENTRATION ON EXHAUST EMISSIONS IN CUSTOMER TYPE VEHICLE OPERATION. Preprint, Society of Automotive Engineers, Inc., New York, 19p., 1969. 9 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690015.)

Effects of various concentrations of tetraethyl lead on exhaust emissions were investigated. Eight Ford Galaxies equipped with production non-exhaust emission-equipped 289-CID, 2-V engines were operated in customer service for 19,000 miles in the Detroit area. Four fuel blends were used in mileage accumulation. All engines were operated on the same petroleum base engine lubricant. Exhaust emissions were monitored at approximately 3000-mile intervals using the California Motor Vehicle Pollution Control Board seven-mode procedure. Additional seven-mode tests were obtained on each engine after combustion chamber deposits were removed at the completion of the mileage accumulation phase. The increase in exhaust hydrocarbon emissions of vehicle operation on the leaded fuels was substantially higher than the hydrocarbon increase of vehicles operated on Indolene Clear (a full boiling range non-lead gasoline). At the 12,000 mile point, for example, the average hydrocarbon increase for the leaded fuels was approximately 100 ppm as hexane, while the hydrocarbon increase on Indolene Clear was negligible. No deleterious effect, due to the fuel used, was observed on any engine component. (Author abstract modified)

4936 APTIC NUMBER 10461

Hall, C. A., A. P. Pelt, and W. J. Brown
EVALUATING EFFECTS OF FUEL FACTORS ON STABILIZED EXHAUST EMISSION LEVELS. Preprint, Society of Automotive Engineers, Inc., New York, 20p., 1969. 5 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690014.)

Single-cylinder engine studies showed that the severity of the test cycle used for deposit accumulation markedly affects the level of exhaust emissions obtained with stabilized combustion chamber deposits. These studies also show that the relative stabilized emission levels with non-leaded and leaded fuels vary significantly with the aromatic content of the base fuel. An extensive evaluation in three groups of passenger cars operated by their owners in normal service showed no significant difference between the stabilized emission levels obtained with commercial non-leaded and leaded fuels. A dynamometer engine test procedure was developed that simulates short-trip, city-type operation. The accelerated cooldown procedure allows for rapid accumulation of test mileage. Use of this dynamometer procedure showed that a prototype highly aromatic non-leaded fuel produced a higher deposit stabilized emission level than that obtained with an average presently used leaded fuel. (Author abstract modified)

4937 APTIC NUMBER 10580

Harney, T. P.
VANADIUM CATALYSTS FOR SULPHURIC ACID. Chem. Met. Eng., 37(6): 376, 1930. 2 refs.

Recent literature on sulfuric acid catalysts suggests that vanadium catalysts, unlike platinum, cannot bring the system SO2-O2-SO3 into equilibrium in a short space of time at optimum temperature. This is not true of commercial vanadium compounds whose reaction velocities are such that equilibrium can be reached quickly at high temperatures permitting 97-98% conversion. From a commercial standpoint, the operation characteristics of vanadium and platinized magnesium sulfate and platinized asbestos (above 400 C) are identical. However, vanadium is insensitive to the poisons affecting platinum, and its performance is consistent. As a result, vanadium gives higher average conversions than platinum.

4938 APTIC NUMBER 15202

Hobbs, Peter V. and J. D. Locatelli
ICE NUCLEI FROM A NATURAL FOREST FIRE. J. Appl. Meteorol., 8(5):833-838, Oct. 1969. 2 refs.

The results of measurements of ice nuclei made downwind of a natural forest fire are reported. The concentrations of ice nuclei in the air active at -21 C were measured with an acoustical ice nucleus counter. During the period of heaviest smoke at the Weather Bureau station at Stampede Pass, Wash., the ice nucleus count rose to a value almost eight times greater than the count in clear air. The results appeared to demonstrate conclusively that the forest fire in which the measurements were obtained was producing ice nuclei.

4939 APTIC NUMBER 14999

Holobrady, K., J. Toth, J. Hanus, and M. Jedlickova
CHARACTERISTIC OF SOLID AEROSOL PARTICLES EXHALED FROM THE CEMENT WORKS, PART I. (Charakteristika tuhych aerosolovych castic exhalovanych z cementarni, I. cast). Text in Czech. Pol'nohospodarstvo, 14(7):525-538, 1968. 24 refs.

Experiments were made on the dispersity, morphology, chemical and mineral composition of solid aerosol particles. Samples were collected by passive sedimentation at places of maximum dust fall near five Slovak cement works. The particles have a large spectrum, characteristic of a polydisperse system and are classified as thick, disperse aerosols of 1-10 microns. A large portion of the particles is irregularly anisometrically shaped, with uneven porous surfaces and sharp edges. Aerosols in flue dust have a high alkali and sulfate content. From thermal and X-ray analysis, it was concluded that solid aerosol particles from cement works originate in pure and processed raw materials as well as in clinker materials. (Author summary modified)

4940 APTIC NUMBER 15176

Inouye, Hikita, Yuji Watanabe, and Satoshi Nakajima
AN ESTIMATE FOR THE DISTRIBUTIONS OF THE GROUND-LEVEL CONCENTRATION DOWNWIND DUE TO MULTIPLE SOURCES. (Taju osengen ni yoru fuka no chijo nodo bunpu ni tsuite no 1 kaiseki). Text in Japanese. Eisei Kogaku (J. Hyg. Chem.), no. 12:1-14, March 1966. 11 refs.

Estimates were made for the distribution of the downwind ground-level concentrations from multiple sources which continuously emit sulfur dioxide. The estimate was found by superimposing a dose pattern of each isolated stack. Pasquill's formula was used for the determination of atmospheric dispersion, and the Oak Ridge formula was used for determining the effective stack heights. Field observations were conducted in parts of industrial districts at Muroran under neutral atmospheric conditions. The calculated maximum concentration was located nearer the source than was observed. This difference was more than expected by the variation of the dispersion coefficients or the topography factor. The Oak Ridge formula underestimated the effective stack heights. (Author abstract modified)

4941 APTIC NUMBER 14367

Kaiser, E. R.
THE INCINERATION OF BULKY REFUSE. II. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 129-135. 5 refs. (May 5-8).

Conventional incinerators are not designed to cope directly with logs, tree stumps, branches, truck tires, demolition lumber, furniture, mattresses, pallets, and the like. Landfill space is limited and must be conserved by reduction in the volume of refuse. Tests are described which show the practicability of hearth-type furnaces for the incineration of bulky refuse. The oversized waste is charged by tractor into the furnace. Burning rates average 18 lbs/hr/sq ft of refractory hearth area. Smoke, produced by the presence of hydrocarbons and the rapid rate of devolatilization of part of the waste, is burned out in a secondary chamber with excess air, turbulence, and time. Fly ash emission is kept low because of minimal flow of underfire air. Tests of two primary chambers of a bulk-charge furnace 20 times 10 times 12 ft high are given and the findings are coordinated with guidelines to designers. Also shown are proposed designs for incineration of 2 to 20 tons per hour.

4942 APTIC NUMBER 15750

Kampf, W. D.
THE BURDEN ON CITY AIR DUE TO MOTOR VEHICLES WITH PARTICULAR CONSIDERATION OF BROAD STREETS. (Belastungen der Grossstadtluft durch Kraftfahrzeugabgase unter Berucksichtigung weitraumig gebauter Strassen). Text in German. Arch. Hyg. Bakteriol. (Munich), 153(8):304-311, 1969. 20 refs. (Presented at a meeting of the German Society for Hygiene and Microbiology, Mainz, Oct. 7-8, 1968.)

Exhaust gases from motor vehicles were measured in heavily loaded traffic areas. Carbon monoxide was measured in a wide Western Berlin street with average traffic, surrounded by buildings.

Measurements showed that exhaust gas contamination in the air is generally a permanent load on the large population groups of the city. Even at a distance of 11 meters from the stream of traffic, measurements obtained at a height of 1.75 meters reached 35 ppm. During rush hours, the 3-hour mean value reached 3 ppm CO. In many cases, the concentration reached 7-9 ppm CO, and occasionally, up to 20 ppm CO. The average hourly maximum values clearly showed a dependency upon the traffic load and a concentration range up to 5.5 ppm. It was also concluded that the velocity of the air has an influence upon the exhaust-gas distribution. The load caused by permanent minor air contaminations was also discussed. (Author summary modified)

4983 APTIC NUMBER 14697

Klinksiek, F. P.
PARTICULAR PROBLEMS WITH EXHAUST GAS ANALYSIS AT VOLKSWAGENWERK AG. Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1968. 6 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 8-12, 1968, Paper 680122.)

Emission and durability tests of 1968 Volkswagens are reported. Exhaust emissions from cars made in Europe and the United States were measured by a dynamometer and analyzed for hydrocarbon and carbon monoxide content by infrared and flame ionization detection methods. To determine if any correlation exists between present or proposed emission standards and test procedures, European, Japanese, and American tests were used to calculate exhaust gas flows and quantity of pollutants. Carbon monoxide concentrations in the European test procedure are 1.3 times higher than in the official U. S. test procedure. Concentrations of hydrocarbon in the European test procedure is lower than in the U. S. procedure, reflecting the influence of deceleration which is more rapid in the U. S. test. If U. S. emission standards were based on mass emission rather than on concentration, mass emissions of carbon monoxide would be higher in U. S. test procedures. This is attributed to the relationship between carbon monoxide and exhaust gas volume. Higher average speed in the U. S. test results in a higher exhaust gas volume. Fuel consumption does not correlate significantly with emissions, but combustion tends to be better with the U. S. test procedure. Worldwide legislation on emission standards with one common test procedure is recommended.

4984 APTIC NUMBER 13615

Knabe, Wilhelm
EXPERIMENTAL STUDY OF THE FLUORINE CONCENTRATION IN NEEDLES AND LEAVES OF PLANTS AS FUNCTION OF THEIR HEIGHT ABOVE GROUND. (Experimentelle Pruefung der Fluoranreicherung in Nadeln und Blaettern von Pflanzen in Abhaengigkeit von deren Expositionshoehe ueber Grund.) Translated from German. Landesanstalt fuer Immissions und Bodennutzungsschutz des Landes Nordrhein- Westfalen, Essen (Germany), p. 101-116, Sept. 1968. 6 refs.

The ability of many types of plants to absorb fluorine from the air and store it in the leaves makes this pollutant particularly well suited for studies of the pollutant intake by plants, as function of the immissions in ground level atmospheric layers. Therefore, field tests were performed of a distance of 8.6 km from a fluorine emitting aluminum factory. The plants were set up in containers at various heights above ground. The factory emits approximately 30 kg F/h, about 80 percent in the gasepis state and 20 percent as dust. The wider aim of the experiments was to find correlations between the amount of excessive fluorine in plants and characteristic immission parameters. In the narrower range of our field experiments, the fluorine intake of overground plant organisms as a function of the height of the plant above ground was studied. All plants had the same soil and the same water supply. A detailed description is given of the experimental procedures and equipment. The results pertain only to the period from October to November, and October to February, respectively, and only to fluorine containing emissions from one aluminum plant. The increase of the fluorine content in plant organisms with increasing height above ground or in the first row facing the aluminum plant in the fall and winter of 1967/68 confirms earlier field experiments. For further analyses of the fluorine content in plant organisms it must be kept in mind that not only the physiological age and the sampling time but also the height above ground and the position toward the emission source ought to be comparable.

4985 APTIC NUMBER 14933

RECORD OF THE 61ST CONGRESS SPECIAL COMMITTEE MEETING ON THE TREATMENT OF INDUSTRIAL POLLUTION. COUNTERMEASURES TO PUBLIC NUISANCE DUE TO GASOLINE AND AUTOMOBILES. (Dai 61 kai kokkai shugiin sangyokogai taisaku tokubetsu iinkai. Sekiyu narabini jidosha nioru kogai no taisaku nikansuru shitsugi kara). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(10): 853-856, Oct. 1969.

A discussion on automobile exhaust and gasoline pollution was presented. The Ministry of International Trade and Industry estimated the approximate growth rate of heavy oil and automobile demand as the following: the demand for the heavy oil will be increased 1.83 times by 1970 and 2.1 times by 1970. These figures will remain valid even if atomic energy is available on an industrial scale. It is not practical to restrict automobile production because of air pollution. If such a restriction were put into effect, it would lead to the importation of automobiles from abroad. It would be more practical to control automobile exhaust by technical methods. With respect to gasoline pollution control, the present tendency for control is to reduce the importation of heavy oils from Middle East countries and to increase the importation of heavy oils from African and Asian countries, since the latter contain less sulfur. It is difficult, however, to change the proportion of imports to a great extent in a short time. Therefore, the improvement of technical methods for fuel desulfurization and development of natural gas production are the most practical under present circumstances.

4946 APTIC NUMBER 15587

Kumai, Motoi
FORMATION AND REDUCTION OF ICE FOG. Army Terrestrial Sciences Center, Hanover, N. H., Cold Regions Research and Engineering Lab., DA Task 1P061102B52A02, RR235, 29p., March 1969. 9 refs.
DDC: AD 691 325

Studies dealing with ice fog and ice crystals were conducted during January and February of 1962, 1963 and 1968 at Fairbanks, Alaska and vicinity. The results of an investigation of the amount and extent of air pollution and ice fog in the area are presented, with special emphasis on reducing ice fog by decreasing the water vapor being emitted into the atmosphere. The major sources of water vapor at two military installations in the region, are the heating and power plants and their associated cooling ponds. In the populated areas around Fairbanks, a high aerosol concentration of about 100,000 particles/cu cm exists, while in the uninhabited areas the concentration is extremely low (about 300 particles/cu cm. Much of the high concentration is due to the burning of coal for heat and power. Because the coal is of low grade, it also emits about 350,000 kg of water vapor into the atmosphere on a day when the temperature is -40 C. This water vapor condenses on the aerosols and produces ice fog. Anthracite or semi-bituminous coal would reduce the water vapor output to only one-fifth of the amount produced by the low grade coal. Water vapor from cooling ponds can be reduced by freezing the surfaces of the ponds. (Author abstract modified)

4947 APTIC NUMBER 12176

Landen, Ernest W.
NITROGEN OXYDES AND VARIABLES IN PRECOMBUSTION CHAMBER TYPE DIESEL ENGINES. Preprint, Society of Automotive Engineers, Inc., New York, 11p., 1963. 8 refs. (Presented at the Soc. Automotive Engrs. International Summer Meeting, Montreal, Canada, June 10-14, 1963.)

Nitrogen oxides produced in the combustion of compression ignition engines are of some significance because they are quite reactive and can attack lubricating oils and engine parts. Measured amounts in the exhaust gases of diesel engines can be used to evaluate those factors in operation and design which are important in controlling the quantities produced. In the precombustion chamber type of diesel engine, the local peak combustion temperature influences the formation of nitrogen oxides. These localized peak temperatures are controlled by such factors as fuel-air ratio of combustion, duration of fuel injection, timing of fuel injection, inlet manifold air temperature, engine speed, and supercharging. Data presented indicate how these variables affect the formation of nitrogen oxides as measured in the exhaust gases. Higher inlet temperatures and more rapid mixing of the fuel and air than is used in today's precombustion chamber engines are conducive to the formation of larger quantities of nitrogen oxides.

4948 APTIC NUMBER 15795

Lee, Robert, E., Jr., Ronald E. Patterson, Walter L. Crider, and Jack Wagman
CONCENTRATION AND PARTICLE SIZE DISTRIBUTION OF PARTICULATE EMISSIONS IN AUTOMOBILE EXHAUSTS. Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 25p., 1969(?). 24 refs.

Particulate samples of hot, concentrated automobile exhaust were fractionated and collected with cascade impactors in a specially designed sampling chamber. Samples of cool, diluted auto exhaust were also taken, and some were exposed to photoirradiation. Lead, nitrate, sulfate, and chloride components in exhaust emissions were predominantly of submicron size, a finding that is consistent with atmospheric measurements. In hot, concentrated automobile exhausts, more water soluble than water insoluble lead was found. The particle size distributions of sulfate and nitrate showed a monotonic temperature dependence, the average sizes decreasing with increasing exhaust temperature. With irradiation, the concentration of water soluble lead increased, and the concentration of water insoluble lead decreased. Two possible mechanisms, both based on photochemical transformation of lead compounds, are proposed as explanations for the relatively lower amount of lead that accumulates in the bones of mice exposed to irradiated exhaust. Irradiation produced an increase in the concentrations of particulate chloride, sulfate, and nitrate but a decrease in the average particle sizes. The particle size distribution of chloride in diluted exhaust was influenced by added SO2, while irradiation produced a narrow distribution of chloride in particles below 1 micron diameter with and without added SO2. (Author summary modified)

4949 APTIC NUMBER 13753

Levenets, N. P., G. A. Lobukhov, and A. M. Samarin
FORMATION OF DUST DURING SCAVENGING OF CAST IRON WITH OXYGEN. (Obrazovaniye pyli pri produvke chuguna kislorodom). Text in Russian. Izv. Akad. Nauk SSSR, Metal. no. 5:11-14, 1968. 9 refs.

The process of dust formation during metal scavenging with oxygen and gas-oxygen mixtures was investigated. The intensity of dust formation is basically determined by the carbon content in the melt. Increase in the intensity of the scavenging leads to increased dust content of exhaust gases. The FeO content of the dust was 5-10% when the carbon content in the metal was greater than 2% but was 15-20 if the carbon content in the melt was lower. Microscopic analysis of the dust indicated that the form and size of the dust particles also depended on the carbon content. If the melt contained about 4% carbon, fine reddish irregularly-shaped particles of about 4 in. diam were formed, while with 2% carbon, the particles were black and of about 25-40 in. size. To reduce the dust formation, it is necessary to prevent reduction in the temperature of the reaction zone and the oxidation potential in the gas phase at high carbon concentrations in the melt. It was shown that the use of natural gas considerably lessened dust formation particularly at carbon contents higher than 2%.

4950 APTIC NUMBER 15351

Levy, Arthur, Salo P. Miller, and Francis Scofield
PHOTOCHEMICAL SMOG: AN APPRAISAL OF KETONE REACTIVITY.
Am. Chem. Soc., Div. Org. Coatings Plastics Chem., Preprints, 29(2):427-440, 1969. 10 refs. (Presented at the 158th Meeting of the Am. Chem. Soc., Div. Organic Coatings and Plastics Chemistry, New York, Sept. 1969.)

The photochemical smog reactivity of ketones and the relationships between structure and reactivity among ketones were determined. Twelve ketones were injected into a reaction mixture in a smog chamber. It was concluded that all aliphatic straight chain and branched ketones are only mildly eye irritating. Within one standard deviation, all aliphatic ketones yield the same response time. Ketone-like materials such as mesityl oxide and isophorone are more eye irritating than other ketones. This was attributed to their unsaturated structures. The data showed that branched chain ketones are chemically more reactive than straight chain ketones. Branched chain ketones are only slightly more reactive than straight chain ketones with respect to photochemical smog products and eye irritation. Ozone production is also more pronounced in the photooxidation of branched chain ketones.

4951 APTIC NUMBER 14798

Liedmeier, G. P.
PREVENTION OF ATMOSPHERIC POLLUTION IN PETROLEUM REFINERIES.
(La prevention de la pollution atmospherique dans les raffineries de petrole). Text in French. Pollut. Atmos. (Paris), 11(Special):3-8, Feb. 1969.

A review of atmospheric pollution and problems in controlling it in the refineries of Europe is presented. The author discusses the founding of CONCAWE (Conservation of Clean Air and Water--Western Europe), which is a group of oil companies and societies representing 80% of the refining capacity in Western Europe. Its functions are to process information pertaining to pollution by refineries and the joint study of pollution problems. It now has working groups in the following areas: study of the height of chimneys and atmospheric dispersion; liquid effluents; petroleum pipelines; subterranean migration of petroleum; and noise abatement. The sources and effects of refinery pollution, particularly by sulfur oxides, hydrocarbons, and malodorous gases are reviewed. Particulate matter and nitrogen oxides are considered of secondary importance. A brief review of methods for combatting pollution is also included.

4952 APTIC NUMBER 13952

Lindberg, Walter
AIR POLLUTION IN NORWAY. I. THE GENERAL AIR POLLUTION IN NORWEGIAN CITIES AND INDUSTRIAL TOWNS. (Den almennelige luftforurensning i Norge. I. Generelt om luftforurensning i byer og tettbygde strok.) Translated from Norwegian. Oslo Univ. (Norway), p. 1-65, 1968. 12 refs

General information is presented on air pollution in Norway with attention focused on (1) the sources and types of pollutants: motor vehicles, heating plants, incinerators, (2) air pollution levels in the cities, including dustfall, SO2, and smoke measurements in Oslo, Sweden, (3) special investigations (sulfuric acid fog), the chemical composition of solid particulates in smoke and suspended dust, polynuclear hydrocarbons and particulates, trace elements, (4) pollutants in Norwegian cities other than Oslo, (5) directions for medicohygienic evaluation of pollution levels in cities and other densely populated districts and industrial regions, and (6) an evaluation of the economic consequences of air pollution.

4953 APTIC NUMBER 14393

Lord, G. Ross and Hans J. Leutheusser
MINIMUM STACK HEIGHTS FOR APARTMENT BUILDINGS. Toronto Univ., Canada, Dept. of Mechanical Engineering, TP 6602, 15p., June 1966.

A catalogue of minimum stack heights for roof-mounted chimneys is presented. The catalogue comprises the common types of high rise apartment buildings, block-type structure, symmetrical and unsymmetrical L-shaped structures, symmetrical U-shaped structures, and three-winged structure. The suggested minimum heights correspond to the local values of maximum separation-cavity thickness. Notwithstanding the possibility of partial entrainment of chimney effluents into the separation cavity, the determined minimum stack heights may prove conservative. If the structure is located in a built-up area, other buildings in its vicinity may deflect the air stream sufficiently to cause a decrease of the separation-cavity thickness on its roof. The results of a plot of data indicate that both the height of the obstructing building and its distance from the sheltered structure have a significant effect on the magnitude of the cavity thickness which clearly tends toward a definite minimum value at some optimum spacing. Heights might also be conservative because of the effect of velocity ratio which is the ratio of gas emission speed to wind velocity and one representative wind direction. Data indicated that the high relative momentum flux of the stack gases could well be a substitute for physical stack height. However, since the applicable velocity ratio is generally controlled by the wind velocity which itself changes at random, little reliance can be placed in its beneficial effects unless the stack exit velocity is consistently very high. In the case of apartment buildings, the stack velocities are usually quite small and subject to seasonal fluctuations. As a consequence, stack heights corresponding to the local values of cavity thickness appear to be more appropriate for structures of this kind.

4954 APTIC NUMBER 15043

Los Angeles County Air Pollution Control District, Calif.
INITIAL REPORT OF THE AIR POLLUTION CONTROL DISTRICT OF THE COUNTY

OF LOS ANGELES. (Presented before the U. S. Federal Power Commission in the Matters of Transwestern Pipeline Co., Docket no. CP63-204, CP68-93; El Paso Natural Gas. Co., Docket no. CP68-76; Gulf Pacific Pipeline Co., Docket no. CP63-223. 46p., 1965.)

Evidence is presented indicating that fuel oil burning by industry and power plants is seriously affecting public health in Los Angeles and could lead to a major disaster. To combat this acute air pollution problem, industry and power plants must be provided with year-round natural gas service at higher levels than those of Pacific Lighting's Tailored Supply Program. Unless the power plants and industry can change to a cleaner fuel, sulfur dioxide and nitrogen oxide levels, which already exceed most modern recommended standards, will increase dramatically in the next 15 years. These pollutants in combination with sulfates and particulates are contributing causes of severe respiratory illness. Other air pollution problems wholly or partially attributable to fuel oil burning are damage to vegetation and property, reduced atmospheric visibility, and aggravation of photochemical smog. If natural gas were substituted for fuel oil, daily emission of nitrogen oxides could be reduced by 85 tons, sulfur dioxide by 410 tons, and particulates by 31 tons. The peak periods for these pollutants are December, January, and February, refuting the contention of oil and gas companies that pollution is not a problem in winter.

4955

APTIC NUMBER 15358

Mache, R. and P. Authier
CONVERSION OF THE STEAM ELECTRIC GENERATORS OF THE ARRIGHI CENTRAL STATION TO FUEL OIL. (Transformation au mazout des generateurs de vapeur de la centrale Arrighi). Text in French. Le Genie Civil, 142(5):82-104, March 1, 1965. 1 ref.

An extensive account is given of the history of the Arrighi steam electro-generating station and of the engineering and economic aspects of its conversions from powdered coal to natural gas and, finally, to fuel oil. Operational characteristics of the latest installations are given, and the environmental aspect of the station is discussed at some length. During a total of two years before and after the conversion to fuel oil, continuous measurements of the SO2 content of the air were carried out at three locations in the vicinity of the station by bubbling filtered air through water at a known rate and determining the rate of formation of H2SO4 in the latter. In the winter, domestic emissions of SO2 were found to exceed greatly those of the station, which uses fuel oil with 0.35 to 0.96% S in the winter and with 2.25 to 3.0% S in summer. To lower the sulfur content of the flue gases, a built-in apparatus is used to inject powdered dolomite or magnesium carbonate into the combustion chambers of the boiler furnaces and powdered dolomite only into the combustion gas ducts. The dolomite powder dosage is 1 kg/ton of fuel oil per % S in the oil. These injections were found to have beneficial secondary effects as well. By rebuilding the stacks higher and slimmer and by elimination of reheaters, the stack exit speed of the flue gas was raised from 6 to 20 m/sec and its temperature from 120 to 185 C, thereby raising the altitude of the flue gas plume 100 m above its pre-conversion value and thus greatly improving the pattern of flue gas dispersion in the atmosphere.

4956

APTIC NUMBER 16013

Maria, Gubola
ON THE PROBLEMS OF THE ODOUR-PARAMETER OF AIR POLLUTION. (A legszennyezodes szagparameterenek kerdeseirol). Text in Hungarian. Vodaras (Budapest), 73(1):38-43, Jan.-Feb. 1969. 14 refs.

One of the important aspects of air pollution which is often neglected is the odor of pollutants, an aspect which can no longer be disregarded. The sources of odors, the quality and intensity of odors, methods of odor assessment (subjective observation, instrumental measurements, mathematical determination), and methods for the elimination of odors are reviewed. (Author summary modified)

4957

APTIC NUMBER 16767

Markus, G. A., Yu. G. Ozerskii, and V. I. Oratovskii
DISCHARGES TO ATMOSPHERE AT THE PHENOL WORKS. Coke Chem. (USSR) (English tanslation from Russian of: Koks i Khim.): no. 1:37-39, 1969. 4 refs.

The quantity and composition of discharges from the phenol works were determined. Discharges come from breather valves in operational equipment as a result of evaporation from equipment operating under a vacuum which discharges drawn-off gases, and from spent gas leaving the unit for springing sodium phenolates with carbon dioxide. The vacuum pump discharges contain hydrogen sulfide and ammonia. Impurities such as pyridine bases, phenols, neutral aromatic hydrocarbons, hydrogen sulfide, and ammonia enter the common collector. Measurements revealed that the volume of the gas-air mixture discharged to the atmosphere through the collector is 600-800 cu m/hr. Two-liter samples were taken over a 30-min period and analyzed. The fluctuations of the various contents were ascribed to changes in the composition of the raw materials that were processed and in the operating conditions of the plants. The maximum concentrations of the noxious discharges were calculated. The results indicated that the content of phenols, hydrogen sulfide, and other impurities exceeded the maximum standards and must be reduced 10-20 times. It was concluded that work should be done to reduce the volume of discharge by strict observance of the process conditions to ensure that minimum discharges and effective equipment be developed to trap noxious impurities.

4958

APTIC NUMBER 14914

Marshall, W. F. and R. W. Wurn
FACTORS INFLUENCING DIESEL EMISSIONS. Preprint, Society of Automotive Engineers, Inc., New York, 12p., Aug. 1968. 6 refs. (Presented at the West Coast Meeting, Soc. Auto. Engrs., San Francisco, Calif., Aug. 12-15, 1968, Paper 680528.)

Smoke, odor, and other emissions of concern in environmental pollution from four diesel engines were studied experimentally. Engine design, operational mode, and fuel characteristics were considered as variable factors influencing the emissions. The engine included a turbocharged 4-cycle unit, normally aspirated 4-cycle units, and an air-scavenged 2-cycle engine. All were direct injection, truck-type power units. Fuel characteristics differed widely among eight fuels used in the study, with principal differences occurring in sulfur and aromatic content. Results of the experimental study showed that emissions levels in all categories are markedly influenced by engine operation. Within the group of engines tested, generally high emissions of unburned hydrocarbons are associated with the 2-cycle design, high smoke levels with the 4-cycle normally aspirated engines, and high emissions of NO(x) and oxygenates with the turbocharged 4-cycle engine. Exhaust odor intensity levels were roughly equivalent for all engine types. Emissions in all categories were surprisingly insensitive to variation in fuel characteristics, with the exception that smoke levels were significantly reduced with addition of a smoke suppressant additive to the fuel. Neither of two odor inhibitors was found effective. (Author abstract modified)

4959 APTIC NUMBER 12161

McKee, Herbert C. and George C. Lawrason
A STUDY OF ETHANOL-GASOLINE BLENDS AS AUTOMOTIVE FUEL. Preprint, Southwest Research Inst., San Antonio and Houston, Texas, 11p., 1968. (Presented at the 57th Annual Meeting of the Air Pollution Control Association, Houston, Texas, June 21-25, 1968.) Paper 68-76.

An investigation of ethanol-gasoline blends as a fuel for modern automotive engines was undertaken. Primary emphasis in the early phases of the program was devoted to determining the operating characteristics of typical automobile engines with various amounts of ethanol added to conventional gasoline. Along with this investigation, a few preliminary tests were made to determine the amount of unburned organic vapor emitted in the exhaust, comparing the emission of an ethanol-gasoline blend with the emission of a leaded gasoline of the same octane number. It was immediately evident that a significant reduction in hydrocarbon concentration occurred with the ethanol-gasoline blends, and additional work was performed to investigate this particular factor in more detail. It is concluded, however, that before a large scale change in fuel composition are undertaken, several factors needed extensive investigation.

4960 APTIC NUMBER 15512

Weland, Bruce R. and Richard W. Boubel
A STUDY OF FIELD BURNING UNDER VARYING ENVIRONMENTAL CONDITIONS. Preprint, Oregon State Univ., Corvallis, Dept. of Mechanical Engineering, 20p., 1966. 5 refs. (Presented at Air Pollution Control Association, Annual Meeting, 59th, San Francisco, June 20-24, 1966, Paper 66-9.)

Burning of grass land in August and September is a source of serious air-pollution problems in the Willamette Valley, Oregon. To determine the effect of environmental variables on the burning and conditions for significantly reducing pollution, field studies were conducted on the burning of Common ryegrass and English ryegrass. Both independent and dependent variables were measured and the results statistically analyzed to determine significant variables and their relationships. The amount of suspended particulates was not significantly dependent on soil moisture; the burn rate for Common ryegrass depended on wind speed, air temperature, and number of days after harvest, while the burn rate for English ryegrass depended on wind speed and soil moisture; surface temperature in the case of Common ryegrass was relatively unaffected by independent variables, but surface temperature in the case of English ryegrass depended on regrowth, wind speed, straw moisture, soil moisture, relative humidity, and air temperature; the amount of organics in particulates was not dependent on independent variables; smoke color depended on straw moisture; and soil moisture loss showed no significant dependence on independent variables. For the time being, pollution can be minimized by burning earlier in the season if regrowth is involved. This will facilitate weed and disease control and reduce the amount of emitted suspended particulates. Burning at low straw moisture conditions will lower the visual pollution effect. By defining the range of variables involved, the study provides preliminary information for finding alternate means of control.

4961 APTIC NUMBER 15205

Murozumi, M., Tsaihwa J. Chow, and C. Patterson
CHEMICAL CONCENTRATIONS OF POLLUTANT LEAD AEROSOLS, TERRESTRIAL DUSTS AND SEA SALTS IN GREENLAND AND ANTARCTIC SNOW STRATA. Geochim. Cosmochim. Acta, 33(10):1247-1294, 1969. 71 refs.

Lead analyses in annual ice layers from the interior of northern Greenland and in annual layers of ice from the interior of the Antarctic continent are reported. It was shown that lead concentrations increased from less than 0.001 micrograms/kg ice in 800 BC to greater than 0.2 micrograms/kg ice today in north pole ice sheets. The sharpest rise occurred after 1940. The levels of lead in south polar ice sheets were generally below detection limits before 1940 and rose to about 0.020 micrograms/kg ice after 1940. The increase of lead with time in north polar snows was ascribed mainly to lead smelteries before 1940 and to burned lead alkyls after 1940. The difference between the concentrations of lead in northern and southern polar snows was ascribed to barriers to north-south tropospheric mixing which originate from meridional circulating cells and which hinder the migration of aerosol pollutants from the northern hemisphere to the Antarctic. Observations of the chemical concentrations of the common elements in ice from the interior of Greenland and Antarctica were explained in terms of simple relations among sea salts and terrestrial dusts. Ten times more dust and one-half as much sea salt were found in Greenland interior ice than in antarctic interior ice. The proportions of Na, Cl2, Mg, Ca, and K adhered closely to sea salt ratios in ices that were relatively

free of silicate dusts. The amounts and chemical composition of silicate dusts in Greenland were no different in coastal and interior ices. There are seasonal variations in the amounts of pollutant lead, sea salts, and silicate dusts in the snows. Pollutant lead and sea salts were 2-3 times more concentrated in winter than in summer snows, while silicate dusts were three times more concentrated in spring than in winter snows. The interpretation of the data was consistent with most related chemical and meteorological observations at temperature latitudes. (Author abstract modified)

4962

APTIC NUMBER 15399

NATURE AND CONTROL OF AIRCRAFT ENGINE EXHAUST EMISSIONS. Northern Research and Engineering Corp., Cambridge, Mass. Contract FH22-68-27, Report 1138-1, 388p., Nov. 1968. 208 refs.

The results of a study of the emissions of air pollutants by aircraft engines in the U. S. are presented. The study included four aspects of aircraft engine emissions: the nature of aircraft engine emissions and quantities emitted, the effects or impact of aircraft engine emissions on the populace, the reduction of emissions, and governmental control of the emissions. In addition, emission control requirements were considered and guidelines developed for determining the degree of control needed. The principal conclusion drawn from the study is that the nature and extent of air pollutant emission by aircraft can be assessed with sufficient accuracy to allow a comparison between aircraft and other emissions sources. On that basis, aircraft are a small contributor of pollutants in metropolitan areas. In the vicinity of air terminals, however, the density of pollutant emission by aircraft and the resulting pollutant concentrations are comparable to emission densities and concentrations in adjacent communities of the same pollutants from other sources. Thus, the principle impact of aircraft is local in nature and is expected to become more severe in future years. It is also likely that aircraft emissions will constitute a more significant portion of community-wide pollutant loadings as new aircraft are introduced and as emissions from other sources are reduced. It is further concluded that whenever a reduction of aircraft emissions becomes desirable, a variety of practical approaches exist to reduce both the quantities of pollutants emitted and their impact on the community. Specific conclusions relative to emission reduction and emission control are presented. A program of activity with regard to aircraft emission is recommended. All emission data is tabulated.

4963

APTIC NUMBER 13552

Oldright, G. L. and Virgil Miller
SMELTING IN THE LEAD BLAST FURNACE. Trans. AIME (Am. Inst. Mining Metallurgical and Petroleum Engrs.), Vol. 121, p. 82-105, 1936. 3 refs.

Experimental work from 1931 to 1936 related to the increased capacity of the blast furnace was reviewed. Three lead smelters treating three distinctive types of lead including a rich lead charge and a charge high in zinc were considered. Methods of preparation for the blast furnace, as in double sintering, were examined, particularly with respect to chemical composition and size of the feed. Experiments to improve sintering practice involved finding the optimum bedding on pellets according to particle size, and analyzing ignition of the bedding charge, moisture in the charge, recirculation of gases, and size of beds. The reducing power of the blast furnace gases was considered in terms of the producer-gas reaction, CO2 plus C yields 2CO.

4964

APTIC NUMBER 13733

Oshio, Toshiki
PUBLIC NUISANCE IN TODAY'S JAPAN: AIR POLLUTION. (Wagakuni no kogai no genjo: taiki osen). Text in Japanese. Doboku Gakukaishi (J. Japan Soc. Civil Engineers), 54(6):13-17, June 1969.

Falling dust, floating dust, and sulfur oxides are the three major air pollutants in Japan. Falling dust, which includes relatively large particles that tend to fall easily, is collected and measured by a deposit gauge in tons/sq km/month. With the increased use of petroleum and the decreased use of coal, plus the development and improvement of dust-collecting apparatus, the amount of falling dust has decreased since 1961, especially in large industrial cities such as Kitakyushu, Osaka, and Kawasaki. However, very small falling dusts which cannot be removed by dust-collecting equipment, are still present in the same high concentrations and are easily carried to distant places. Floating dust, which is much smaller than falling dust and is measured in micrograms/cu m by a dust meter or air sampler (tape-air sampler, or high volume air sampler) is also decreasing with the reduced use of coal. The concentration of the floating dust is high in winter, and heaviest at 9 a.m. and 8 p.m. Osaka-Kobe, Tokyo-Yokohama-Kawasaki, and Nagoya still have concentrations of floating dust higher than 300 micrograms/cu m. Metallic components of floating dust, some harmful to man, include Fe, Cu, Pb, Mn, and Ti. Sulfur oxides (SO2, SO3 and/or sulfuric acid produced in the air) have been gradually increasing with the increasing use of petroleum. They are measured by the lead dioxide procedure or automatically by electricity conduction ratio. Concentration of sulfur oxides has doubled in Yokohama, Amagasaki, Ube, and Chiba within 5 to 6 years, and its concentration in recent years is especially high in Osaka, Kawasaki, and Tokyo. The government of Japan passed laws in December, 1968 and February, 1969 to prevent air pollution caused by sulfur oxides. Air pollution caused by the exhaust gas of automobiles has been gradually increasing, as Japan is the world's second largest manufacturer of automobiles. Harmful components of exhaust gas are CO, nitrogen oxides, lead, and carbohydrates including 3,4-benzopyrene. Cities such as Tokyo, Osaka, and Nagoya show especially high concentrations of these components. Odorous hydrogen sulfide, chlorides, and mercaptan, plus heavy metals such as Hg, V, and Cr contribute to the problem of air pollution in Japan.

4965 APTIC NUMBER 15381

Popescu, V. G., P. Capetti, C. Olaru, V. Dobre, and C. Nastase
CONTRIBUTION TO THE STUDY OF ATMOSPHERIC POLLEN AND MOLDS IN CITIES B. AND G.B. (SOUTHERN CARPATHIAN MOUNTAIN REGION OF ROMANIA). POLLEN. NOTE I. (Contribution a l'etude du pollen et des moisissures atmospheriques des villes de B. et de G.B. (Region sous-carpatique meridionale de la Roumanie). Pollen. Note I). Text in French. Acta Allergol., 24(1):32-38, March 1969. 18 refs.

Comparative studies were undertaken in the village of B., where hay fever and bronchial asthma are frequent and the village of G.B., where pollenosis is rare. Quantitative measurements of atmospheric pollen were made with a Durham apparatus having thin plates covered with Calbera solution placed horizontally and vertically to register variations due to drafts. Measurements were taken at heights of 1, 2, 5, and 15 m. Non-allergenic pollen was found to occur to a greater extent in the village of B. throughout the year. The occurrence of grass pollen, which begins around May 15 and lasts until the middle of August, was 1.5 times as great as that in the village of G.B. The quantities of Quercus, Ulmus, and Populus pollens were equal in both towns. It was difficult to correlate the incidence of pollen with the high incidence of pollenosis in the village of B. in the year 1967. The amount of grass pollen in this town only partially explains the higher occurrence of pollen allergies. It is concluded that mold, atmospheric movements, and other irritating factors may be influential.

4966 APTIC NUMBER 15769

Pursall, M. P.
POLLUTION IN ROAD TUNNELS. Consulting Eng., 33(8):57-58, Aug. 1969. 9 refs.

The sources and causes of the build-up of pollutants in road tunnels are discussed. The two main sources of poisonous exhaust gases are gasoline and diesel engines. Diesel exhaust emits a smaller percentage of carbon monoxide than the gasoline engine, but because the diesel engine is larger, it emits a larger volume. The diesel engine also produces more nitric oxide and nitrogen peroxide. Vehicles emit up to 50% more carbon monoxide on the up-gradient than on the level; on the down gradient, they emit 40% less. In calculations for two-way tunnels, an average figure for carbon monoxide emission can safely be taken. Tests showed that the amounts of carbon monoxide and other combustion products vary directly with speed. Differences in tunnel concentrations for the Sumner Tunnel in Boston and the Central Tunnel in London were attributed to different vehicle speeds and variations between British and American vehicles and fuels. The variations resulted in higher concentrations of lead and hydrocarbons in the Sumner Tunnel; carbon monoxide concentrations were similar for average daytime periods in both tunnels. The effects of carbon monoxide, nitrogen oxides, and lead compounds are briefly discussed. It was concluded that if the concentration of CO can be diluted to below 100 ppm, the concentration of nitrogen oxides and other gases should be relatively harmless. Visibility should also be satisfactory under these conditions. In a 2 way tunnel, the maximum ventilation rate was calculated to be 200 cu ft/min/ft. With one way traffic, ventilation is induced from the portals by the moving vehicles, but additional artificial ventilation would be necessary when the traffic is stopped or moving slowly. In most large tunnels, alarms operate if the CO concentration exceeds 250 ppm.

4967 APTIC NUMBER 13618

Reh, L.
FLUIDIZED BED INCINERATION. (Verbrennung in der Wirbelschicht.) Translated from German. Chem. Eng. Tech. 40(11):509-515, 1968. 12 refs.

The use of fluidized bed incineration is limited, among other things, by the combustion temperature, the caloric value of the fuel and the gas velocity in the turbulent layer. By adequately controlling the combustion process a very narrow temperature range can be maintained, which is demonstrated by various examples (roasting of sulfide ores at various types of cooling, regeneration of pickling bath, incineration of oil and waste sludge).

4968 APTIC NUMBER 14378

Roggendorf, Alexander
DOES THE CHANGEOVER TO GENERATION OF ELECTRICITY IN NUCLEAR POWER PLANTS LEAD ONE TO EXPECT A CHANGE OF STRUCTURE OF THE CURRENT DISTRIBUTION NETWORKS/ (Laesst der Uebergang zur Stromerzeugung in Kernkraftwerken eine Strukturaenderung der Stromverteilungsnetze erwarten/). Text in German. Elektrizitaetswirtschaft, 67(3):89-92, Jan. 29, 1968.

Power generation using heavy fuel oil, a by-product in the refining of mineral oil, is rather new in Germany. Price of heavy fuel is low, and with the development of oil refineries everywhere in the country, more such power plants could be erected. In spite of the fact that nuclear power plants will inevitably become predominant within the next ten or twenty years, these heavy fuel oil-fired power plants will probably last a long time, since oil will be refined for the use of engine propellant well into the next century. Furthermore, it is less expensive to use the heavy oil in power plants than to hydrate it for additional propellants. With the advent of more nuclear power plants, the tendency to produce electricity at the site of consumption rather than erection of long-distance networks will certainly become more prominent. Industries may then develop in parts of the country which so far have lacked primary energy. Network costs will decrease, and industries will be able to spread out and benefit everyone.

4969 APTIC NUMBER 15109

Ross, K.
CONDENSATION OF SULPHURIC ACID FROM FLUE GAS ON A COOLED CYLINDER. J. Inst. Fuel, 38(293):273-277, June 1965. 19 refs.

Convective mass transfer principles were used to derive an equation for the rate of condensation of sulfuric acid on a

surface cooled below the acid dewpoint of the flue gas. Rates of condensation calculated from the equation were compared with those measured on a cylindrical probe at different surface temperatures in a laboratory-produced flue gas. At temperatures down to 100 C, good agreement exists between the predicted and experimental results, but at surface temperatures below 100 C the measured rates tend to fall away from the predicted ones. As predicted, the measured rate of acid condensation at surface temperatures below the acid dewpoint (148 C) increases rapidly to a maximum, and then falls off with further cooling of the surface. In general, the deposition rate reaches a peak at about 20 to 40 C below the dewpoint. The results show that for surface temperatures between the acid dewpoint and that of the observed peak rate, the rate of condensation is related to properties of the system as expressed in the equation for the mass transfer rate by gaseous diffusion at the cylinder surface.

4970 APTIC NUMBER 15698

Sakai, Takeshi
FORMATION OF CARBONACEOUS PRODUCTS DURING THE COMBUSTION OF HEAVY FUEL OIL DROPLETS. (Juyu nensho ni okeru tansoshitsu no seisei). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 48(508):603-610, Aug. 20, 1969. 29 refs.

The carbonaceous products generated during the combustion of heavy fuel oil spray can generally be classified into two groups: the product which is formed from hydrocarbon fuel by evaporation or gasification, so-called 'soot'; and the residual carbon, so-called 'coke'. They are generated in the process when a large carbon molecule is pyrolyzed and a polymerization or condensation reaction of the generated radicals occurs at the same time. The development of these carbonaceous products can be determined by their appearance or X-ray analysis. When a relatively fine spray is subjected to combustion, 'soot' is burned out and 'coke' is mainly exhausted. If the distribution function were applied to heavy fuel oil droplets and one heavy fuel oil droplet was assumed to form one residual carbon particle, a grain size distribution and mean particle diameter of residual carbon could be theoretically formulated. The calculated curve as compared with the observed histogram, and the calculated mean diameter as compared with the measured mean diameter from this equation were in fair agreement. From the result of the study, the following process can be supposed to remove exhaust residual carbon particles: residual carbon particles, generated from the maximum particles of atomized heavy fuel oil, should be burnt out completely in a combustion chamber. The following countermeasures depress carbonaceous products generated by combustion of atomized heavy fuel oil: minimizing the diameter of maximum droplets; improving the nozzle; using oil of proper viscosity against the nozzle; using additives; obtaining less residual carbon particle exhaust against a spray of the same maximum droplet diameter; improving combustion conditions and oxygen mixture diffusion; enlarging the combustion velocity; increasing the chamber temperature; adding combustion catalysts and making the combustion chamber larger for a sufficient reaction time and decreasing the combustion load.

4971 APTIC NUMBER 14895

Sallee, Elgin D.
FOUR TYPES OF AIR POLLUTION. Mod. Lithography, 36(9):79-81, 84, 87, Sept. 1968.

Air pollution emissions and control methods involved in the operation of coating ovens for metal decorating are reviewed. Particulates or smoke from litho or coating oven exhaust stacks consist primarily of breakdown by-products of the resin or drying oil in the coating or ink during the bake. Several methods of reducing plume density are mentioned; it is noted, however, that these apply mainly to diluting stack gases and simply reducing their visibility, rather than to decreasing the absolute amount of emissions. Odorous pollutants are the most difficult to control; the bulk of the odors from coating ovens come from aldehydic and other resin-breakdown products that have very low odor thresholds despite their low concentrations in stack air, rather than from the more frequently blamed solvent vapors which have much higher concentrations but also higher thresholds. No one method of odor control has been found completely satisfactory, but the most success has been obtained by incinerating stack gases at 1300 F or more. Vapors of many of the solvents and thinners used in coating ovens are photochemically reactive and thus of major concern in areas where other conditions tend to promote smog formation. Because of stringent regulations in the Los Angeles area, all coating ovens must have solvent-elimination devices if the solvent amounts to more than 15 pounds per day. Some general discussion is given to the problems of applying various control methods to coating ovens, including high and low temperature incineration, catalytic oxidation, and scrubbing and adsorption systems.

4972 APTIC NUMBER 14924

Sawyer, R. F., L. S. Caretto, and E. S. Starkman
THE FORMATION OF NITRIC OXIDE IN COMBUSTION PROCESSES. Preprint Abstract, Combustion Institute, Pittsburgh, 2p., 1968. 7 refs. (Presented at the Combustion Inst., Central States Sect., Tech. Meet. on Pollut. Problems Associated with Combust., Columbus Ohio, March 1968.)

Nitric oxide (NO) formation was investigated in several combustion environments including laboratory burner flames, stirred reactors, gas turbine combustor models, piston engines, and industrial and aircraft gas turbines. Hydrocarbon and ammonia fuels were studied with air as the oxidizer. Theoretical considerations were based upon both equilibrium and kinetic models in attempts to predict the composition of the combustion products for comparison with the experimental observations. Although the differences in the observed NO concentrations in different combustors seemed to emphasize the strong influence of combustor design, some trends were present which may be explained on the basis of theoretical arguments. From equilibrium composition calculations, the concentration of NO in combustion products was shown to be strongly dependent upon both the mixture ratio and product temperature, but not upon the combustion pressure. Kinetic processes prevent the equilibrium of NO concentrations in

expansion of combustion products. Recent evidence indicates that NO formation is kinetically controlled in some combustion processes and that concentrations may fail to reach or, in some cases, even exceed equilibrium predictions. Studies of premixed ammonia oxygen flames in a porous plug burner reveal NO at greater than predicted equilibrium concentrations. The singular role of nitrogen from ammonia in the formation of oxide is under current investigation. NO concentrations in a well-stirred reactor, ammonia combustion in a reciprocating engine, and NO infrared emission during the expansion process were recently measured. High NO levels were indicated. Measurement of nitric oxide from gas turbine combustors indicate that NO concentrations depend strongly upon the combustor configuration and even possibly upon the temperature-time history of the products in the turbine and exhaust systems. Studies of piston engine expansion processes show NO levels to be frozen early in the expansion process; concentrations are not simply related to the equilibrium levels predicted for peak cycle temperatures. (Author abstract modified)

8973 APTIC NUMBER 14580

Schoening, M. A. and R. H. Wright
INTENSITY OF THE ODOR REVERSE AT VARIOUS POINTS IN THE KRAFT PULPING PROCESS. TAPPI, 35(12):564-569, Dec. 1952. 6 refs.

The concentration of hydrogen sulfide and methyl mercaptans in various plant effluents were surveyed in a study of the problem of odor reduction in kraft processing. Species of wood cooked were western hemlock, Douglas-fir, and red cedar; each was cooked separately and the concentration of malodorous gas measured at the following points: digester relief and gas-off, blow gases, evaporator effluents, furnace gases, stack gases, green liquor tank vapors, and sewer outfall. Results indicated that a higher concentration of mercaptan, on occasion 100,000 micrograms per liter, is given off in the noncondensable gas from a fir cook than from a hemlock cook, a fact that may be due to the turpentine formed from fir. Blow tank vapors were clearly the major source of odor since no attempt was made to condense the stream in the digester discharge. The use of raw sulfur produced a two to threefold increase in the mercaptan concentration in noncondensable gases. Though the total volume of condensable and uncondensable gases released from the blow tank could not be measured, rough calculation suggest that the loss of sulfur may have exceeded 20 lb per cook. Stack gases carried about one third as much odorous material as the noncondensable blow gases and at a much lower concentration. Neither furnace gases nor evaporator effluents constituted a high intensity source of odor.

8974 APTIC NUMBER 15352

Scofield, Francis
AIR POLLUTION FROM SOLVENTS. Am. Chem. Soc., Div. Org. Coatings Plastics Chem., Preprints, 29(2):393, 1969. (Presented at the 158th Meeting of the Am. Chem. Soc., Div. Organic Coatings and Plastics Chemistry, New York, Sept. 1969.)

The organics and plastics coatings industries are among the major contributors to photochemical smog. A significant contribution arises from the evaporation of organic solvents. The reactivity of solvents varies over a wide range and a substantial reduction in the amounts of reactive materials contributed by solvent evaporation may be achieved without a corresponding reduction of the total solvents. The only effective way to date of establishing the relative reactivity of these compounds is an empirical method which exposes a mixture of the solvent and nitrogen oxides to irradiation. A number of photochemical reactors of this type are in operation and many of them provide for the direct determination of eye irritation. It is very difficult to predict reactivity of individual solvents, and since there is a wide variety of reactions which may take place, not all of which lead to eye irritation or other damaging products, even a high degree of reactivity is not necessarily an indication that a solvent is objectionable. An accepted order of reactivity by classes of compounds is that, in general, olefins are the most reactive and should be controlled at the lowest level. Aromatic compounds are less objectionable but still require control, while most oxygenated and aliphatic materials are relatively innocuous and under present conditions do not appear to require control. However, within each of these classes a wide range of reactivity can be encountered. More information in this area is necessary in order to guide the writing of future regulations and possibly the revision of current controls.

8975 APTIC NUMBER 14899

Scott, W. H.
LOOKING IN ON DIESEL COMBUSTION. Society of Automotive Engineers, Inc., New York, SP-345, Tech. Paper 690002, 16p., Dec. 1968. 9 refs.

High-speed cine photography was used to study the combustion process in a variety of diesel chambers. These chambers, used in engines of 12-1200 cu in. swept volume per cylinder, differ considerably in the level of air utilization achieved within the cylinder at acceptable exhaust color or temperature. These differences attributed to the method of fuel/air mixing employed; the influence of fuel injection, air motion, and fuel quality are discussed. It is shown that high air utilization depends at present on the use of a high level of air motion. By comparison the mixing contributed by the fuel spray energy is very poor. Fuel quality contributes little to the mixing process, but has some influence over the control of combustion rate. Although there is an obvious correlation between air utilization and the level of air swirl or turbulence employed, high gas velocities are nonetheless undesirable. Maintaining present levels of performance under low swirl conditions will depend largely on the ability of the fuel injection equipment to achieve good mixing and combustion control with reduced gas velocities.

4976 APTIC NUMBER 14478

Seidl, W.
ON THE QUESTION OF POWER PLANT EMISSIONS. (Zur Frage der Kraftwerkemissionen). Text in German. Brennstoff-Waerme-Kraft, 21(5):265-267, 1969. 3 refs.

Important developments in the field of CO2, SO2, and fly dust emissions in the U. S. are briefly summarized. Computations and estimations of the CO2 emissions conducted by the National Center for Air Pollution Control of the Public Health Service showed that since 1890, the annual CO2 emissions have increased enormously, and by the year 2000, they are expected to have increased 18 times. The highest growth has been predicted to fall within the period from 1965 to 1985. The CO2 emitted by thermal power plants stems primarily from the combustion of coal. In the past, thermal power plants played a rather unimportant role as emission sources for CO2. In the period between 1980 and 1990, they are estimated to become major sources of CO2 emissions. By the end of the century, vehicles will again be the prominent CO2 emission source. Presently in the U. S., about 40 times 10 to the ninth power tons per year of CO2 are emitted; this figure will rise to almost 100 times 10 to the ninth power by the year 2000. The Institute of Industrial Medicine of the New York University Medical Center studied fly ash from electrostatic precipitators in various thermal power plants fired with bituminous coal from the Appalachians. Their radiochemical analyses yielded average radioactivities of Ra226 plus Ra228 of 6.2 pc/g. If it is assumed that a power plant with a capacity of 1000 MW consumes 2,000,000 tons/year of such coal with an ash content of 4%, and if 2.5% of the ash leave the precipitator, a fly ash emission of 4.5 times 10 to the 9th power g/year with a radioactivity of 28 mc/year is obtained. As far as desulfurization is concerned, the dolomite process will be used by Union Electric and the Tennessee Valley Authority.

4977 APTIC NUMBER 13528

Shibuya, Toshikazu
ENGINE PERFORMANCE SEEN FROM THE EXHAUST SMOKE DENSITY OF SINGLE CYLINDER DIESEL ENGINE. 2ND REPORT. DEPENDENCE OF AIR-FUEL RATIO AND PRODUCTS OF COMBUSTION ON THE EXHAUST SMOKE DENSITY. (Haikien nodo yori mita tanto diesel kikan seino. Dai 2 ho. (Haikien nodo to kuki-nenryo hi, oyobi haiki gasu sosei.) Text in Japanese. (Shiga Kenritsu Tanki Daigaku Gakujutsu Zasshi (Scientific Reports of Shiga Prefectural Junior College)), no. 8:1-5, March 1967. 12 refs.

Relationships among air-fuel ratio, smoke density and concentration of some components of exhaust gas from a single cylinder diesel engine running at low speeds were investigated with an air-fuel ratio meter and a gas detector. The measurement of exhaust smoke density vs. air-fuel ratio at 900, 800 and 750 RPM shows that, for each speed smoke density increases rapidly from relative minimum points. These minimum smoke densities are between 2.7 and 2.8 at air-fuel ratios of 26, 28 and 33:1 for 900, 800 and 750 RPM, respectively. Decreasing engine speed increases smoke density for any given air-fuel ratio. The results of the experiments on the effect of air-fuel ratio on CO, SO2, and NO2 emission showed that CO is minimum at an air-fuel ratio of about 26:1. It increases rapidly at lower ratios and at 22:1 reaches 0.01%, the so-called maximum permissible value for CO. Carbon monoxide concentration exceeds 0.01% at light engine loads. Sulfur dioxide rapidly increases and exceeds 10 ppm (maximum permissible value) at air-fuel ratios lower than about 22:1. It decreases at higher ratios. Nitrogen dioxide concentration is minimum at an air-fuel ratio of about 23, increasing at both higher and lower ratios. Its concentration is always lower than 25 ppm, the maximum permissible value. It is proposed that an output at a smoke density of 2.7-2.8 or an air-fuel ratio of 26-27 be used as a normal output and an output at a smoke density of 3.3-3.8 or an air-fuel ratio of 22 be used as a maximum, when determining emissions from small diesel engines.

4978 APTIC NUMBER 13628

Shibuya, Toshikazu
ENGINE PERFORMANCE SEEN FROM THE EXHAUST SMOKE DENSITY OF SINGLE CYLINDER DIESEL ENGINE. 2ND REPORT. DEPENDENCE OF AIR-FUEL RATIO AND PRODUCTS OF COMBUSTION ON THE EXHAUST SMOKE DENSITY. (Haikien nodo yori mita tanto diesel kikan seino. Dai 2 ho. (Haikien nodo to kuku-nenryo hi, oyobi haiki gasu sosei.) Text in Japanese. (Shiga Kenritsu Tanki Daigaku Gakujutsu Zasshi (Scientific Reports of Shiga Prefectural Junior College)), no. 8:1-5, March 1967. 12 refs.

Relationships among air-fuel ratio, smoke density and concentration of some components of exhaust gas from a single cylinder diesel engine running at low speeds were investigated with an air-fuel ratio meter and a gas detector. The measurement of exhaust smoke density vs. air-fuel ratio at 900, 800 and 750 RPM shows that, for each speed smoke density increases rapidly from relative minimum points. These minimum smoke densities are between 2.7 and 2.8 at air-fuel ratios of 26, 28 and 33:1 for 900, 800 and 750 RPM, respectively. Decreasing engine speed increases smoke density for any given air-fuel ratio. The results of the experiments on the effect of air-fuel ratio on CO, SO2, and NO2 emission showed that CO is minimum at an air-fuel ratio of about 26:1. It increases rapidly at lower ratios and at 22:1 reaches 0.01%, the so-called maximum permissible value for CO. Carbon monoxide concentration exceeds 0.01% at light engine loads. Sulfur dioxide rapidly increases and exceeds 10 ppm (maximum permissible value) at air-fuel ratios lower than about 22:1. It decreases at higher ratios. Nitrogen dioxide concentration is minimum at an air-fuel ratio of about 23, increasing at both higher and lower ratios. Its concentration is always lower than 25 ppm, the maximum permissible value. It is proposed that an output at a smoke density of 2.7-2.8 or an air-fuel ratio of 26-27 be used as a normal output and an output at a smoke density of 3.3-3.8 or an air-fuel ratio of 22 be used as a maximum, when determining emissions from small diesel engines.

4979 APTIC NUMBER 14487

Shoji, H., K. Nishida, M. Komatsu, S. Yamada, T. Denda, S. Takada, and A. Hasegawa
THE STUDIES ON THE AIR POLLUTION DUE TO AUTOMOBILE EXHAUST GASES (REPORT 12). TOTAL AMOUNT OF EXHAUST GASES IN KYOTO-CITY. Jidosha haiki ni yoru taiki osen no kenkyu (Dai 12 ho). Kyoto-shi ni okeru haiki seihun no hai shutsu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):92, April 1969.

A method for calculating total automotive exhaust gases in Kyoto is based on estimates of the average amount of exhaust gases per automobile per running cycle and the ratio between traffic density in center city and the surrounding areas. Assuming that (1) the ratio between center city and outlying traffic is 2.2 to 1.0; (2) the total number of cars varies between 200,000 to 300,000/day; (3) all have gasoline engines; and (4) the running cycle for center city is the RC type and for the circumferential area the MI type, the total amount of exhaust would be 128.0 to 127.2 tons CO/day and 17.8 to 18.8 tons of hydrocarbons per day for 200,000 cars and 186.0 to 198.8 tons CO/day and 26.8 to 28.2 tons of hydrocarbons per day for 300,000 cars.

8980 APTIC NUMBER 14972

Smith, David B. and David B. Scott
COMPREHENSIVE AIR POLLUTION CONTROL PLAN. PART ONE. DATA SUMMARY. AIR POLLUTION AND METEOROLOGY. David B. Smith Engineers, Inc., Gainesville, Fla., HUD Proj. FLA. P-65, 38p., July 1968. 23 refs.
CFSTI: PB-186678

A background study of air pollution in Palm Beach County identifies and locates the county's major emission sources. Climatological and meteorological conditions which increase the severity of pollution are described. It was found that common air pollution complaints to the county involve commercial incineration in close proximity to residential areas, caused by careless operating procedures. Improperly operated, the 74 approved small commercial incinerators produce soot, fly ash, and smoke. Seven sugar mills and two major fossil-fuel electric generating plants emit significant quantities of smoke and related pollutants due to either improper operation, low grade plant fuel, or can field burning with uncontrolled emissions. Pratt & Whitney Aircraft emits atmospheric pollutants on an occasional short-term basis. Burning of junked automobile hulks and production of asphalt contributes to the emissions. Only in the Pahokee-Belle Glade area do dustfall measurements exceed a median residential-commercial threshold concentration of 14.4 tons/square mile/month under average conditions. All sampling points experience greater maximum dustfall concentrations except Royal Palm Beach. Dustfall concentrations in Riviera Beach, West Palm Beach, Palm Springs, Delray Beach, Boca Raton and the Pahokee-Belle Glade area exceed the standard concentrations for strictly residential areas. Salhaven, Cross State, Boca Raton Rubbish, Lake Park, Pahokee North, and Belle Glade solid waste disposal sites practice open burning of wastes. Uncontrolled burning at some of these sites greatly reduces night time visibility along major transportation arteries including the Sunshine State Parkway. (Author abstract modified)

8981 APTIC NUMBER 14923

Smith, Russell A., Lee I. Wikstrom, and Arrigo A. Carotti
AIR BORNE EMISSIONS FROM MUNICIPAL INCINERATORS. SUMMARY REPORT OF STATE OF KNOWLEDGE, RECOMMENDATIONS FOR FURTHER STUDIES AND AN ANNOTATED BIBLIOGRAPHY. New York Univ., University Heights, N. Y., Chem. Eng. Dept., Contract PH 86-67-62, 35p., May 1967. 56 refs.

Studies of emissions from municipal incinerators were reviewed and found to be relatively limited in number as well as in scope. Some are concerned only with particulate, CO2, CO, H2O, O2, and N2 emissions while others are concerned with the parameters and the parameters influencing the quantity of emission. In general, these analyses were conducted during normal, steady-state incinerator operating conditions. More detailed identification and quantitation were restricted to particulates and hydrocarbons. New York City area studies seemed particularly few in numbers. The following recommendations for future studies are made: sample and analyze stack discharge from municipal incinerators in the New York City metropolitan area; determine the rate of discharge of specific chemicals over a 12-month period, with emphasis on toxic substances; determine the rate of discharge when the incinerator is operated at design capacity and/or at capacity loading that meets local air pollution control requirements; and determine variations in general composition. A brief summary paragraph is given with most of the references.

8982 APTIC NUMBER 15452

Smith, Ralph T.
AIR-POLLUTION PROBLEMS OF THE PHOSPHATE INDUSTRY. (Bureau of Mines and Geology, Montana, Western Phosphate Region, Proc. Ind. Seminar West. Phosphate Reg., Butte, Mont., 1966, p. 46-48, June 1967. (Special Pub. 42).

Materials from the phosphate industry which contribute to air pollution are listed as follows: solids, such as natural dust and organic particles, industrial dusts such as carbon and fly ash from the combustion of fuels, and fine dusts; gases, such as sulfur dioxide and trioxide, hydrogen fluoride, silicon tetrafluoride, chlorine, hydrogen chloride, carbon monoxide and dioxide, nitrous and nitric oxide, ammonia, alcohols, and ozone; and water vapor and mists, which are liquid from condensation of water and acids on suitable nuclei. The noxious gases come from two sources in the phosphate industry: a wet process called denning, and from calcination processes. As the gases or smoke come out of the stack, they may either continue upward, spread out and diffuse, or an inversion or turbulence may cause a rapid downward trend a short distance from the stack. Smoke and fumes have both psychological effects (depression and general irritation) and physiological effects (the irritation of membranes of the nose, throat, and lungs by the inhalation of gases; a toxic effect in the stomach of animals who eat contaminated vegetation). Methods for the removal of solids are listed as follows: a long flue equipped with baffles and settling chambers; a filtering system such as a bag house; and the cyclone. The most economical and effective way of removing noxious gases is by scrubbing. Sulfur gases may also be sent through a sulfuric acid plant. Fluorine gases may be removed by forcing the gases through a bed of limestone; the absorption causes a chemical reaction to take place, forming inert calcium fluoride. Other removal methods mentioned include the following; electrostatic precipitation; and sonic precipitation.

4983 APTIC NUMBER 13951

Sorenson, S. C. and H. K. Newhall
KINETICS OF HYDROCARBONS IN ENGINE EXHAUST SYSTEMS. Preprint, Combustion Inst., Central States Section Sp., 1968. (Presented at the Meeting of the Central States Section of the Combustion Inst., Columbus, Ohio, March 1968.)

Chemical reactions possibly occurring in engine exhaust systems are oxidation of hydrocarbons with an attendant reduction in emissions and modification of hydrocarbon structure giving rise to a change in photochemical reactivity or smog-forming potential of the exhaust products. This work consists of a theoretical estimation of the various hydrocarbon reactions which might be of importance. A mathematical model of an isothermal, well-mixed steady-flow system was used. Theoretical results indicate that pyrolysis and oxidation mechanisms may both be of importance in exhaust gas reactions, and that the hydrocarbons ultimately found in the exhaust gas may be significantly different from the parent hydrocarbons. The results also indicate that the time required for complete oxidation is approximately 4 millisec at the high temperatures and free radical concentrations employed. These are extreme values and representative of only a completely insulated exhaust system. The oxidation process is accompanied by a large increase in the rate of energy release due to chemical reaction. Preceding oxidation, a large increase in the concentrations of free radicals and non-fuel hydrocarbons occurs. Significant pyrolysis products building up prior to oxidation include ethylene, acetylene, and methane. All of these are ultimately destroyed in the oxidation process, given sufficient time. (Author abstract modified)

4984 APTIC NUMBER 13547

Spindt, R. S., Court T. Wolfe, and Donald R. Stevens
NITROGEN OXIDES, COMBUSTION, AND ENGINE DEPOSITS. J. Air Pollution Control Assoc., 6(3):127-133, Nov. 1956. (23) refs.

Experimental studies were conducted with single and multiple cylinder engines to determine how the concentration of nitrogen oxides in the exhaust gas varied with operating conditions. Chemical analysis of the exhaust gases verified theoretical conclusions that appreciable nitric oxide should be formed in the combustion process. It was found that nitric oxide always increases with increasing intake pressure, independently of any other fixed variable. In general, the effect of increasing speed is to reduce the amount of nitric oxide because of the decrease in reaction time. The amount of nitric oxide present is controlled by throttle setting and air-fuel ratio. The amount is low at full throttle, rich mixture conditions, but increases at part throttle due to leanness of the mixture. It is concluded that engines operating under normal spark timings with mixtures on the lean side of stoichiometric will produce appreciable nitric oxide, the amount formed depending on the load applied. There appears to be little hope of reducing nitrogen oxides by changes in engine conditions, since optimum economical operation seems to be in the range of high nitrogen fixation.

4985 APTIC NUMBER 15455

Stebliv, F. F., N. A. Panasenko, A. Z. Tsypin, and Yu. D. Timofeyev
EXPERIENCE OF A PLANT IN COPING WITH SULFUR REMOVAL. (Opyt osvoyeniya tsekha seroochistki). Text in Russian. Koks i Khim., no. 7:36-39, 1967.

Within three months it was discovered that installations at the Krivorozhsk Metallurgical Factory had reached their maximum capacity for sulfur removal in the production of sulfuric acid. Modifications to the system, required to cope with increased production requirements, are described. These modifications include the use of larger pumps, better-quality pipes, improved irrigation of scrubbers, etc. Despite a 12-13% increase in acid yield, a 6 g/cu m loss of H2S to the feedback gases indicates need for higher design capacities to allow for the H2S content of the coke gas.

4986 APTIC NUMBER 13620

Stouff, M. L.
STOUFF'S SUSPENSION COMBUSTION HEARTHS. (Les foyers a combustion en suspension Stouff.) Translated from French. Institut Francais des Combustibles et de l'Energie I.F.C.E. p. 341-351, (1958).

A suspension-combustion hearth is discussed which was developed by M. O. Stouff and has been in operation for several years. Emphasis is placed on principles of design, operational procedures, performance results, and recent special applications (thin anthracite coal, and the drying of very damp combustibles).

4987 APTIC NUMBER 15625

Tokyo Metropolitan Government, Japan, Public Nuisance Control Div.
THE EMISSION SOURCES OF NITROGEN OXIDE AND CHROMIC ACID AND THEIR STANDARD CONTROL EQUIPMENTS. (Chisso sankabutsu oyobi kuromusan misuto no hasseigen to sono hyojun jogai setsubi ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(7): 411-419, July 15, 1967.

Nitrogen oxides are emitted by nitric acid plants, sulfuric acid plants, certain kinds of chemical reaction apparatus, and metal surface treating plants. The metals which are treated with nitric acid are copper, aluminum, nickel, iron, and so forth. The nitrogen oxides which are generated by the reaction of metal and nitric acid are nitrous oxide, nitric oxide, nitrogen dioxide, nitrous anhydride, nitrogen peroxide, and nitric anhydride, the primary air pollutants being nitric oxide, nitrogen dioxide, and nitrogen peroxide. Nitric oxide is slowly oxidized by oxygen in the air. Poisoning from nitric oxide only has not been reported,

but it is said to change active hemoglobin into an inactive one. Nitrogen dioxide and peroxide have a stinging odor, lower the blood pressure, and paralyze the nerves. High concentration of nitrogen dioxide above 100 ppm could cause human death. The allowable concentration of nitrogen dioxide is 5 ppm. Nitrogen dioxide is easily absorbed by water and becomes nitric acid, but nitric oxide must be oxidized before washing with water. Since the reaction rate of nitric oxide is very slow, some catalysts such as activated coal must be used. Chromic acid is generated almost exclusively by a chromium plating process. Hydrogen and oxygen gas generated by electrolysis release chromic acid into air, mainly in the form of chromium trioxide which is poisonous and injures the kidneys. The allowable concentration is 0.1 mg/cu m. Chromic acid mist can be absorbed easily by washing with water. The results by the above methods are the following: nitric oxide was reduced from 70,000 ppm to 36 ppm; nitrogen dioxide, from 650,000 ppm to 70 ppm; and chromic acid mist, from 42.65 mg/cu m to 0.077 mg/cu m.

4988 APTIC NUMBER 15562

Toyobura, Masaharu, Minoru Wanjo, and Shizuo Kano
A STUDY ON THE AMOUNT OF LEAD IN THE HAIR OF REGIONAL INHABITANTS. (Fankyo-eisei kara mita tohatsu-chu no namari-ryo ni tsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), vol. 83:81-82, 1965. 8 refs.

The quantity of lead contained in the hair of regional inhabitants was measured in an attempt to compare the degree of air pollution caused by automobile exhaust gas, which contains lead as well as carbon monoxide. Three groups of subjects were selected for this study: residents of the Shinjuku district and policemen from the Yotobashi police station where traffic is busiest; workers at a pharmaceutical plant research laboratory where the traffic is minimal; and residents of Wanio city where the traffic is medium. The amount of lead in the hair was measured after decomposition of the hair by nitric acid. Higher concentrations of lead were observed in the hair of subjects who lived or worked where the air was polluted by automobile exhaust gas. In general, the hair of females contained more lead than the hair of males in the same district.

4989 APTIC NUMBER 15599

Vendramini, P., G. G. Calapai, and G. Mausa.
A CHEMICAL AND STATISTICAL STUDY ON THE POLLUTION OF THE INTERNAL ATMOSPHERE OF THE AUTOVEICLES FROM EXHAUSTED GASES. (L'inquinamento da gas di scarico nell'atmosfera interna degli autoveicoli.). Text in Italian. L'Igiene Moderna, 62(1-2):3-26, Sept. 1969. 31 refs.

In the metropolitan area of Padua, Italy, and on national and local high-ways branching out from this city, data was collected for two seasonal periods: Autumn-Winter (October 1967 to February 1968) and Spring-Summer (March to July, 1968). Urban traffic conditions were classified in three categories: free-flowing (on wider streets outside rush hours), medium (same streets during rush hours), and sluggish (during rush hours on streets less than six meters in width and with a large number of traffic signals). Test automobiles were equipped with two pumps, one at a low level, and one at a high level, which gave readings of atmospheric content between the two front seats. A N/10 solution of sodium hydroxide was used to trap formaldehyde and nitrogen oxide, while 1/1000 palladium chloride was used to detect carbon monoxide. The upper pump drew about 20 liters per minute of air through a SS 602/h paper filter, which captured lead from the air, this could then be extracted from the filter with nitric acid. Each sampling period lasted 10-15 minutes, during which time the vehicle was operated with closed windows, open vents, and no operating fans. All samples were collected on windless days. Results were expressed in ppm (carbon monoxide, nitrogen oxides, formaldehyde) and micrograms/mc (lead). Statistical analysis showed a relationship in the increase of other pollutants with respect to increased CO. Two indexes were calculated: the 'eta' of Cucconi and the 'rho' of Spearman. The other pollutants were found highly correlated with CO concentrations, regardless of seasonal variations. Presence of pollutants in the interior of motor vehicles was sufficiently high to cause hypoxia affecting vision and the higher centers of intellect.

4990 APTIC NUMBER 14980

Vogely, William A.
MODELS OF ALL-GAS AND ALL-ELECTRIC ECONOMIES. In: Energy. I. R. Holmes (ed.), Evanston, Ill., Northwestern University Press, 1968, Chapt. 7, p. 63-82. 3 refs.

Modern technology is greatly increasing the range of technical substitution between primary energy resources to provide useable energy to people; and areas which are now the sole province of a single energy source, such as petroleum and automobile transportation, should in the future become competitive. Ten contingency models of the energy economy are presented as a guide to energy research and development expenditures. A conventional model, reporting the actual 1966 situation and a probability forecast for 1980 and 2000, is the starting point of the analysis. Three all-gas models and six all-electric models are derived. These models illustrate the possibility of achieving resource savings through technology; they also establish outside parameters for specific fuel use. The range in gross energy inputs from the highest to the lowest model is 2.7:1, which widens to 6:1 in terms of resources in the ground. The most efficient, in resource use sense, is the all-gas model utilizing small hydrocarbon air fuel cells for on-site generation of electrical power. The least efficient are oil-fired central generating plants with all energy used in the form of electricity. However, the actual energy mix will be determined by economic factors, not absolute efficiency criteria. (Author abstract modified)

4991 APTIC NUMBER 14680

Wagner, T. O.
COMPOSITION OF DIESEL EXHAUST HYDROCARBONS. Franklin Inst.

Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 241-252.

The technology required to develop an odor standard for diesel engines is being acquired. However, diesel exhausts contain such a wide range of compounds that sampling and analytical procedures are difficult. When no more than an inventory of hydrocarbon compounds is desired, capillary-column chromatographic analysis of a bag sample is adequate, even though many 'heavy' hydrocarbons are lost. Such an analysis revealed the presence of C1 to C18 paraffins. Few, if any, of the light and mid-boiling compounds were present in the fuel. Compounds causing diesel odor are in the C8 to C18 range. Diesel exhaust contains many oxygenated compounds which may be relevant to odor, but their concentrations are low. The effect of fuel on diesel emissions is small. Concentrations of hydrocarbons in diesel exhaust, adjusted for excess-air dilution, are generally below passenger car emission standards.

4992 APTIC NUMBER 10881

THE DIESEL ENGINE AND ATMOSPHERIC POLLUTION. World Health Organization Chronicle (Geneva), vol. 21:201-206, 1967.

The results of an investigation sponsored by the World Health Organization of the role of the diesel engine in air pollution are reported. Emissions from diesel exhausts are discussed and are judged not to be a menace to public health. Although diesel-engine exhausts contain an appreciably greater sulfur oxide content than do those of petroleum engines, the amount is so small that it may be discounted as a source of air pollution except possibly when ventilation is inadequate. A diesel engine, when properly adjusted and maintained, contains only minute traces of carbon monoxide in its exhaust. The chief complaint against diesel engines is the emission of large amounts of malodorous black smoke. It is concluded that engines producing needless smoke are either underpowered or overloaded, and in either case are being overfueled; to prevent this, the use of engines with adequate power to meet maximum loads is essential. Since fuel pumps and injection equipment tend to wear in such a manner as to increase fuel delivery, it would be preferable to use engines of sufficient size to permit their being rated at about 10% below their actual maximum output. Long experience with a large fleet of diesel-powered buses, has demonstrated the de-rating of engines in this manner to be an invaluable and not costly aid in ensuring an acceptable level of exhaust smoke emission.

4993 APTIC NUMBER 15910

Yasuhiro, Yasuhiro, Motoichi Miyazaki, Tsuyoshi Imanishi, Shoji Nando, Yukio Murakami, Shin Kaji, Juichi Hiromori, and Shintaro Kaiho
STUDIES ON METALS IN AIR POLLUTION. VI. ALUMINIUM AND MANGANESE AMOUNTS IN DEPOSITS MEASURED BY RADIOACTIVATION ANALYSIS AND THEIR SEASONAL AND GEOMETRICAL VARIATIONS. (Taiki osen ni kansuru kinzoku no kenkyu (dai 2 ho) hoshaka bunsekiho ni yoru koka baijin chu no aruminium, mangan no sokutei to sono kisetsu oyobi chiiki no hendo ni tsuite). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 15(8):238-243, 1969. 3 refs.

Measurements by radioactivation analysis were carried out for aluminum and manganese in deposits collected from sampling points in the Chiba area. From the analytical data, the seasonal and geometrical fluctuations in the amount of aluminum and manganese were determined. The deposits were collected monthly for a year, and each 10 mg ash of the deposit was irradiated for 1 min at neutron flux: 3 times 10 to the 10th power n/cu cm/sec (5 kw) for aluminum, and 8 times 10 to the 13th power n/cu cm/sec (10 MW) for manganese. Gamma ray spectra were analyzed (aluminum: 1.78 MeV, manganese: 0.83 MeV). The values of aluminum obtained by this method are in good agreement with values determined by ordinary conventional analysis. Seasonal and geometrical fluctuations were not clearly observed for aluminum, but were quite definite in the case of manganese. Large amounts of manganese were present in deposits, especially those from sites near iron works.

4994 APTIC NUMBER 13622

Zurich, R. Tanner
OPERATING RESULTS OF THE INCINERATOR OF THE CITY OF LAUSANNE. (Betriebsergebnisse der Muellverbrennungsanlage der Stadt Lausanne.) Translated from German. Brennstoff-Waerme-Kraft (Duesseldorf), 20(9):430-432, 1968.

The performance of the Von Roll incinerator in Switzerland is discussed based on data compiled for the years 1959 to 1967. Emphasis is placed on investment and operating costs, design (flue gases are cleared using electrostatic precipitators), operating results, and personnel. It is concluded that although the main task of an incinerator is the hygienic disposal of waste, such a plant should operate with enough safety margin to avoid long interruptions. The Lausanne plant owes its success exclusively to the standby units and to its design, which makes monitoring during operation easy for the personnel.

4995 APTIC NUMBER 15208

APTIC NUMBER -----

Agarkova, N. A., M. A. Pyss, V. N. Gusarov, V. P. Zaiko, and T. S. Bedov
PURIFICATION OF THE OUTGOING GASES WHEN FERROTUNGSTEN IS MELTED IN ELECTRIC FURNACES, AND PROSING THE DUST EXTRACTED. Steel (USSR) (English translation from Russian of: Stal'), no. 6:565-567, June 1969. 2 refs.

The gases evolved during the melting of ferrotungsten include particles of rare and toxic substances. A system was proposed for purifying the outgoing gases in which a battery cyclone is followed by an electric filter. This system is an effective means of preventing contamination of the atmosphere. A pyrometallurgical method of reusing the dust enables scarce, costly elements (bismuth and lead) to be extracted. The elements in the dust are selectively reduced. When the dust is remelted in an electric furnace with a shortage of the reducing agent, nearly all the lead and bismuth are extracted to form an alloy. The tungsten is not extracted and remains in the slag. This two-stage method provides a considerable saving due to the additional extraction of tungsten and the sale of a product containing the valuable bismuth.

4996 APTIC NUMBER 15735

Agliardi, N.
ACTIVATED ADSORPTION OF SULFUR DIOXIDE AND OXYGEN OVER A SILVER VANADATE CATALYST. (Adsorbimento attivato di anidride solforosa ed ossigeno su di un catalizzatore a base di vanadato d'argento). Text in Italian. Accad. Naz. Lincei, Ser. 8, Sc., Fis., Mat. Nat., 2:617-622, Jan.-June 1947. 6 refs.

A previous article described a series of experiments with activated adsorption of sulfur dioxide and oxygen over a vanadium oxide catalyst. Improvements in accuracy were obtained by an extrapolation based on the pressure of 341 mm Hg, at which adsorption took place. The oxygen and the sulfur dioxide used were highly purified and completely dry. The catalyst was prepared by immersing silica gel in a 10% silver nitrate so that the silver vanadate from the reaction would precipitate directly into the pores of the silica gel. Determinations of the dry catalyst registered a V content of 3.96% and an Ag content of 20.01%. Four tests each of the adsorption of sulfur dioxide and of oxygen were run from 210-368 C, all at a constant pressure of 341 mm Hg. Results indicated that silver vanadate has about the same catalytic action as vanadium oxide in the adsorption of sulfur dioxide. More energy of activation was present with the silver compound than with the oxide, at least when higher quantities of SO2 were to be absorbed.

4997 APTIC NUMBER 15665

Akbrut, A. T., T. Ya. Vinnik, A. T. Gitsarev, and G. A. Davidovskiy
TESTING THE FIRST ASH-COLLECTING ASSEMBLY WITH A VENTURI SCRUBBER. (Ispytaniye pervoy zoloulavlivayushchey ustanovki so skrubberom Venturi). Text in Russian. Elektr. St. (Moscow), 3(5):30-33, May 1969. 8 refs.

The Ural Branch of the ORGRES (State Trust for the Organization and Rationalization of Regional Electrostations and Networks) developed and put in operation (in April 1967 at the Verkhne-Tagil'sk State Regional Electrostation) the first industrial ash-collecting assembly with a venturi scrubber. This assembly has a high efficiency and reliability, assuring a stable 97% removal with an overall hydraulic resistance of 63-126 kg/sq m and a specific water consumption of 130 kg/1000 cu m (STP). Test operation indicates that this assembly is superior to multiple rod grids. For boiler installations designed for wet removal of ash from flue gases, the use of a venturi scrubber is one practical approach to increasing the efficiency of ash removal.

4998 APTIC NUMBER 13754

Aliyev, G. M. A., A. Ye. Gonik, N. P. Rugayev, and L. M. Meytin
METHODS OF INCREASING THE WORKLOAD OF ELECTROFILTERS FOR COLLECTING HIGH RESISTANCE MAGNESITE DUST. (Metody intensifikatsii raboty elektrofil trov pri ulavlivanii vysokoomnoy magnezitovoy pyli). Text in Russian. Ogneupory (USSR), no. 9:11-18, Sept. 1967. 8 refs.

Electrofilters installed in a caustic magnesite plant several years ago were the basis of experiments to try to improve their efficiency. Cyclones, installed as a first step in purification and operating at an arbitrary gas flow of 6 m/sec, dealing with gas having an intake dust level of 40-55 g/cu nm had an efficiency of 0.82, which was higher than the 0.70 design figure. The electrofilters, installed as a second stage in the purification process and having an operating rate in the active zone of the apparatus of 1.15 m/sec worked with an efficiency rating of 0.847. The low effectiveness of the electrofilters is caused by the large specific electrical resistance of the dust which is equal to 2.7 x 10 to the 13th power ohms/cm at 180 C and also to the insufficient power of the type of semi-automatic supply unit with a mechanical rectifier. Decrease of the gas flow rate and installation of an automatic supply unit for the electrofilter with a semiconductor rectifier increased the efficiency of the electrofilters.

4999 APTIC NUMBER 18750

Amelin, A. G., A. I. Baranova, and J. V. Maslennikova
METHOD OF REMOVING SULFUR DIOXIDE FROM A GAS MIXTURE. (Sposob ochistki gazovoy smesi ot primesey sernistogo angidrida). Text in Russian. (Scientific Res. Inst. of Fertilizers and Insectofungicides, Moscow) USSR Pat. 190,874. 2p., Jan. 18, 1967. (Appl. Oct. 30, 1965, 1 claim).

This method differs from previous ones in that it uses silica gel impregnated with a solution of an alkali metal dichromate (e.g., $K_2Cr_2O_7$ or $Na_2Cr_2O_7$) to remove SO_2 from SO_3 in a gaseous mixture. Complete SO_2 removal from a gas mixture containing 60% SO_3 and 2% SO_2 is reported. In the example, 2500 kg of silica gel treated with potassium dichromate was used to purify 200 cu m (STP) of this gas mixture.

5000

APTIC NUMBER 15271

Andersen, Holger C.
CLEANING OF INDUSTRIAL GASES WITH PRECIOUS METAL CATALYSTS. (Industrielle Gasreinigung mit Edelmetallkatalysatoren). Text in German. Dechema Monograph., 40(516-641):325-33, 1962. 28 refs.

The applications of platinum metals as catalysts for removing acetylene from olefins, cleaning coke-oven gas, and treating residual gases from the nitric acid production are reviewed. Of the family, platinum palladium is particularly suited for the hydration of acetylene so that only a few ppm remain. Recent laboratory tests indicate that at gas throughputs of up to 8500 standard cu m/hr/cu m catalyst, the addition of hydrogen can be reduced to a mole ratio between hydrogen and acetylene of 2. In the case of coke-oven gases, acetylene, nitrogen oxides, carbon oxysulfide, and diolefins are converted into harmless, easily removable compounds by palladium and ruthenium catalysts. Catalytic treatment of residual gases from nitric acid production has three goals: the removal of noxious components, recovery of the nitrogen in pure form for re-use at the ammonia synthesis, and production of heat. Recent laboratory tests show that the process can reduce the nitric oxide content of waste gases to 9 ppm.

5001

APTIC NUMBER 14902

Andersen, L. B. and H. F. Johnstone
GAS ABSORPTION AND OXIDATION IN DISPERSED MEDIA.
Am. Inst. Chem. Engrs. J., 1(2):135-141, June 1955. 8 refs.

The absorption and subsequent liquid-phase reaction of oxygen was studied with two types of dispersion apparatus: the Venturi atomizer and the fritted-glass disperser. The systems studied in both devices included the absorption of atmospheric oxygen by catalyzed sodium sulfite solutions and the simultaneous absorption of atmospheric oxygen with nitrogen dioxide and with sulfur dioxide by water. Very large values of the liquid-film mass transfer coefficient for oxygen absorption were measured in the atomization zone of the Venturi atomizer. Over-all recovery efficiencies were less than 2.3% for nitrogen dioxide but reached as much as 22% for sulfur dioxide. Oxidation efficiencies for sodium sulfite solutions ranged up to 80%, depending on the operating conditions. The fritted-glass disperser gave recovery efficiencies of nitrogen dioxide as high as 90% from air containing 10% of the gas. The recovery efficiency decreased at low concentrations of nitrogen dioxide for both the Venturi atomizer and the fritted-glass disperser. (Author abstract modified)

5002

APTIC NUMBER 14362

Aramaki, Mikio
STUDY ON AIR POLLUTION CONTROL BY ADDITIVE INJECTION. (Mitsubishi Heavy Industries, Ltd., Tech. Rev., 5(3):208-216, Sept. 1968. 6 refs.

Among the problems limiting the application of the limestone method for desulfurizing furnace exhaust gases is the clogging of high-temperature heating tubes in the boiler. An experimental study of the efficacy of alternating limestone injections with magnesium hydroxide injections is reported. Deposits on tubes became soft and powdered and their compressive strength was decreased by intermittent injections of magnesium hydroxide. The method improved the separating property of the deposits. The critical soot-blowing flow rate required in an 8-hr test, 105 m/sec, was reduced to 57 m/sec. Deposition rates decreased. The economy of the method must be confirmed by an actual boiler test. It should be feasible, since the injection apparatus is obtainable at low cost and estimated running expenses, including the cost of magnesium hydroxide, are the same as those required for other dry gas desulfurization processes.

5003

APTIC NUMBER 14766

Aronsohn, Allan
EXHAUST GAS BURNERS. (Assignee not given.) U. S. Pat. 3,460,916. 5p., Aug. 12, 1969. 8 refs. (Appl. July 9, 1965, 6 claims).

The invention provides an exhaust gas burner for internal combustion engines, furnaces, and evacuating plants, which can function continuously without a heat source and without being clogged by solid particles accompanying exhaust gases. The exhaust gas burner has an elongated combustion chamber which connects to an exhaust gas conduit. This permits exhaust gases to flow into the conduit, which has an exhaust gas inlet, exhaust gas outlet, and an air inlet. A liner of catalyzing material coats the walls of the chamber for the continuous ignition of combustible components in the exhaust gases. The combustion chamber is divided into two compartments by a turbulator, which connects the compartments and has a nose facing the exhaust gas inlet. In the first compartment is the exhaust gas inlet and in the second compartment is the exhaust gas outlet. This second compartment also serves as an afterburning zone.

5004

APTIC NUMBER 15309

Atsukawa, Masumi
A PROCESS FOR REMOVING SULFUR OXIDES FROM FLUE GAS. (Sanka io o fukumu nensho gasu no shorihoho). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan) Japanese Pat. Sho 44-18208. 3p., June 24, 1969. (Appl. Sept. 19, 1961, 1 claim).

flue gas is supplied with ammonia at an appropriate location in the passage from a combustion chamber to the outside, where the temperature is below 350 C. The amount of ammonia to be added varies with the sulfur oxides content. The dew point of the gas is lowered by this process. The gas is subsequently led through a gas washing apparatus using ammonium sulfite and ammonium bisulfite solution. Sulfur oxides, ammonia, and its compounds are rinsed off and recovered during this process. Heat energy of the gas is effectively utilized down to low temperatures. Also, the added ammonium and ammonium sulfite or sulfate generated are completely recovered. These features make the present desulfurization process extremely economical.

5005 APTIC NUMBER 10664

Atsukawa, Masumi, Yoshihiko Nishimoto, and Naoyuki Takahashi
STUDY ON THE REMOVAL OF NITROGEN OXIDES FROM EFFLUENT STACK GASES. Mitsubishi Heavy Industries, Ltd., Tech. Rev., 5(2):129-135, May 1968. 9 refs.

Pilot plant tests of the Mitsubishi process for removing nitrogen oxides from stack gases demonstrate that nitrogen oxides can be economically reduced to less than 0.02% of gas content. By limiting threshold concentrations of nitric acid to 200 ppm or below, the method should meet the removal requirements of the major sources of nitrogen oxide emissions: metal pickling plants, nitric acid plants, chemical plants using nitric acid, nitrate, and nitrite plants. Nitric oxide is converted to NO2 by either homogeneous or catalytic oxidation, while nitrogen compounds are recovered through absorption of stack gases in wetted-wall towers packed with PVC sheets. Homogeneous oxidation is a slow process and requires large equipment. However, this equipment is easy to operate. Catalytic oxidation can be performed on small-scale equipment, but the catalyst is affected by water, dust, and mist present in the effluent gas and regeneration is necessary. The PVC equipment has a large absorption coefficient and a small pressure drop.

5006 APTIC NUMBER 13398

Austin, W. C. and W. L. Chadwick
CONTROL OF AIR POLLUTION FROM OIL-BURNING POWER PLANTS. Mech. Eng., 82(3):63-66, April 1960. 2 refs.

California law requires that stack-plume opacity not reach or exceed Ringelmann No. 2 shade for more than 3 min in any hr. To comply with this law, the Southern California Edison Company examined their industrial plumes. Gas emissions were measured for particulates, SO2, SO3, and NO. Plume opacity was found to be significantly affected by the amount and size of particulates, the amount of SO3 present, and the amount of water vapor present. Particulate removal was found to be most efficient with the use of an electrostatic precipitator which removes about 90% of the particulate matter. The most effective removal of SO3, SO2, and NO, 75-90%, could be accomplished by the use of a vanadium catalyst at high temperature, followed by introduction of ozone and electrostatic precipitation. This process proves to be economically unfeasible, however. It was found that NO formation is best limited by delaying the complete combustion in the boiler and protracting the flame path.

5007 APTIC NUMBER 14981

REMOVAL OF SO2 FROM FLUE GAS. AVCO Missiles, Space, and Electronics Group, Wilmington, Mass., Final Report, 157p., Nov. 1, 1967. 10 refs.
CFSTI: PB 177 892

The alkalized alumina for removing of SO2 from power plant flue gases was studied by developing process models for fluid bed and dispersed bed sorption systems. Using the process models, the economics of the two types of contactors were compared, and operating and capital costs were estimated. Preliminary calculations indicate that conditions may be obtained under which the process can be operated with only a small cost penalty. Potentially, with improvement in regeneration and sulfur recovery, the alkalized alumina will operate at a profit while removing 90%, or more, of the sulfur from the flue gas. The optimum operating conditions were determined by estimating the process cost as a function of sorbent loading. The kinetics of the sorption process were measured and found to be pore diffusion controlled over most of the possible range of sorbent loadings. The rate of sorption at sorbent loading greater than 2% SO2 is greatly enhanced by the presence of moisture in the flue gas. At 10% sorbent loading, the rate is over a 100 times as fast in the presence of 5-7% moisture as in the dry flue gas. A rate model describing the sorption process was developed. In the pore diffusion region, the model gives a good account of itself both in theory and in its ability to correlate data, and gives satisfactory description of the sorption rate at loadings exceeding 2% SO2. The rates of regeneration of spent sorbent were also measured at various levels of initial loading from less than 10% of saturation to almost complete saturation. Regeneration was found to increase with decreasing hydrogen pressure, and the percent thermal regeneration was found to decrease as the length of the sorption cycle increased. There was no measurable reduction in the time required for the sorbent to regenerate to constant weight as the gas composition was varied from pure hydrogen to pure carbon monoxide. It is concluded that reformed gases appear satisfactory as regenerating gases.

5008 APTIC NUMBER 14339

Baker, B. S.
HIGH TEMPERATURE ELECTROLYTES. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 477-486.

Some of the problems involved in developing high-temperature fuel cells are briefly discussed. Fuel cells are classified

into low-temperature acid cells, low-temperature alkaline cells, molten salt cells, and high-temperature solid oxide cells. The electrolyte and catalyst requirements of each are reviewed, and the economic and technical difficulties of the high-temperature systems are noted. Costs rise in such systems because of large thermal composition losses and, in super high-temperature methods, because of the very high-cost metals required. Very brief comparisons are made concerning fuel cells in air pollution applications. In comparing the weight of pollutants per million kilowatt-hours from three fossil-fueled central power stations with that from an experimental natural gas-fueled fuel cell system, the amount of pollutants from the fuel cell was so small in some cases as to remain undetected by sensitive instrumentation. A gas-fueled home is compared with one using electric power. The gas-fueled home takes advantage of the relatively pollutant-free fuel cell and a low-cost energy distribution system, thus causing little pollution and using less fuel because of its higher efficiency.

5009

APTIC NUMBER 15619

Markov, M. M. and G. A. Kipanova
AUTOMATIC CONTROL OF A POWDER DUST SYSTEM WITH CYCLONE PRECOMBUSTION CHAMBERS. (Avtomaticheskoye regulirovaniye pylesistemy kotla s tsiklonnymi predtopkami). Text in Russian. Elek. Sta., no. 9:43-46, 1969. 4 refs.

The industrial adoption of installations for preparing pulverized coal using tangential hammer mills, industrial dust hoppers, and fuel drying with high-temperature flue gases has revealed the ineffectiveness of standard designs in the automation of these dust systems and has required the design of fundamentally new systems. The proposed control system would maintain a fixed production rate within plus or minus 1.0 ton/hr and the temperature of the dust-air mixture within plus or minus 2.5 C. It would provide a 25% improvement in productivity over manual control systems, as well as significantly reduce electrical power consumption for pulverizing and conveyance. Automatic control of the air-dust mixture with regulation of the flow rate of the drying agent assures maximum drying efficiency of the dust system. Supplying the temperature regulator with a signal characterizing the change in stoking rate assures stable stoking operations under conditions close to maximum crushing rate. An optimizing scheme which has a stoking rate control and a temperature stabilizing control would adequately allow for the technological characteristics of new dust systems and assure high operating efficiency.

5010

APTIC NUMBER 13472

Beckman, John W.
METHOD FOR REDUCING SULFUR COMPOUNDS FROM FLUE GASES. (Assignee not given). U. S. Pat. 2,718,453. 2p., Sept. 20, 1955. 8 refs. (Appl. Jan. 3, 1951, 1 claim).

A process for the elimination or reduction of sulfur dioxide and sulfur trioxide from flue gases is described. The method comprises blowing finely divided oxides or hydroxides or carbonates of calcium into the combustion gas when it is at a temperature of at least 3[illegible] F. The final products are calcium sulfite and calcium sulfate. An electrostatic precipitator, cyclone dust collector, or bag house may be used to collect these products to prevent them from being exhausted with the flue gases.

5011

APTIC NUMBER 13550

Bent, Franklin A.
PROCESS FOR THE REMOVAL OF NITRIC OXIDE FROM GASES. (Shell Development Co., San Francisco, Calif.) U.S. Pat. 1,888,547, 3p., Nov. 22, 1932. (Appl. May 18, 1931, 20 claims).

A process for removing nitrogen oxides, particularly nitric oxide, from waste gases comprises reduction of the gas with a chromous compound. The products of the reaction are probably hydroxlamine or ammonia, depending on the conditions of the reaction. Chromous salts of organic or inorganic acids may be used, and the reaction should take place at room temperature as high temperatures decrease the amount of nitric oxide taken up by the chromous salt solution. Neutral chromous compounds which are water soluble give the best results. Under certain conditions, it may be advantageous to use chromous compounds in the solid state with or without a support.

5012

APTIC NUMBER 15370

GROUND COKE FOR ADSORPTION OF SULFUR OXIDES. (Coke moule pour l'adsorption d'oxydes de soufre). Text in French. (Bergwerksverband G.m.b.H., Essen, W. Germany) Belgian Pat. 661,702. 9p., April 15, 1965. (Appl. March 26, 1965, 3 claims).

Pieces of porous coke commonly used for adsorption of sulfur oxides from waste gases have the disadvantages that some of the coke is used up during the desorption phase owing to the reduction of SO3 to SO2 with formation of CO2, some of it is oxidized, and much of it is worn off as powder which interferes with the adsorption process. These disadvantages are eliminated by the use of pellets or briquettes with rounded corners molded by compressing with a cylinder press or preferably an extrusion press, a mixture of pulverized non-tacky fuels, either fossil or of recent origin, of 0.1 mm maximum grain size and free of cinders, with 15 to 35 weight % of a binder such as asphalt, tar, or pitch and degassing at temperatures between 500 and 900 C, the degasification is incomplete, and combustible gas is released from the mixture during the adsorption and desorption phases of the desulfurization process, while above 900 C, the absorption capacity of the mixture is impaired. Examples of pulverized fuels that can be utilized are: charcoal dust, peat-coke dust, oil smoke, and powder worn off the coke pieces during adsorption or desorption. Methods of testing the briquettes for impact strength and for absorption capacity are described and results are tabulated.

5013 APTIC NUMBER 15365

PROCEDURE FOR SEPARATION OF SULFUR DIOXIDE FROM GASES. (Procede de separation de l'anhydride sulfureux des gaz). Text in French. (Bergwerksverband G.m.b.H., Essen, W. Germany) French Pat. 1,499,003. 3p., Oct. 20, 1967. (Appl. Nov. 10, 1966, 5 claims).

The invention concerns a procedure for separation of SO2 from gases which contain oxygen and water vapor, and particularly from flue gases, by adsorption in the form of SO2, SO3, and H2SO4 on carboniferous adsorbents. The granular carboniferous adsorbent is impregnated with soluble salts of Fe, Cu, Co, Mn, Cr, or Ce, singly or in combination, which are deposited in amounts of about 1 to 10 weight %. The SO2 adsorption takes place at temperatures below 200 C and preferably between 100 and 160 C. After the adsorbent has become charged with SO2, SO3, and H2SO4, it is reactivated with an inert gas at temperatures between about 550 and 900 C, and then resumes adsorption. The desorption of the sulfur compounds is effected by subjecting the charged adsorbent to a thermal treatment at temperatures between 300 and 550 C prior to its thermal reactivation.

5014 APTIC NUMBER 15377

PROCEDURE FOR ELIMINATION OF SULFUR OXIDES FROM GASES. (Procede pour eliminer des gaz les oxydes de soufre). Text in French. (Bergwerksverband G.m.b.H., Essen, W. Germany) French Pat. 1,528,132. 3p., June 7, 1968. 6 refs. (Appl. May 12, 1967, 5 claims).

The invention concerns a procedure for elimination of sulfur oxides from gases, particularly flue gases which contain sulfur oxides, oxygen, and water vapor, by means of carbonaceous adsorbents. The adsorbent may be activated charcoal or high-temperature coke, and the method involves introduction of ammonia into either the flue gas stream ahead of the adsorber or directly into the bulk of the adsorbent so as to maintain in the latter an ammonia:sulfur oxide ratio of 1:1 to 1:4. The adsorption of sulfur oxides takes place in the adsorbent bulk at a temperature below 200 C and preferably between 80 and 160 C.

5015 APTIC NUMBER 15568

Bertrand, Rene R., Alfred C. Frost, and Alvin Skopp
FLUID BED STUDIES OF THE LIMESTONE BASED FLUE GAS DESULFURIZATION PROCESS. (Interim Report.) Esso Research and Engineering Co., Linden, N. J., Goverment Research Lab., Contract PH 86-67-130, Rept. GR-S-PGS-68, 62p., Oct. 31, 1968. 9 refs.
CFSTI: PB 186 234

Studies were undertaken to determine the feasibility of a limestone fluid bed flue gas process, operating under conditions conducive to attrition of limestone and dolomite sorbents. Current work is directed toward the use of large particles and high CaO utilizations at low temperatures. It was found that coarsely ground limestone and dolomite did not provide high sorbent utilization, even when the coarse particles were calcined under conditions chosen especially to produce porous materials. Only the oxide at or near the surface was observed to react, suggesting that the diffusion of SO2 through the sulfated shell or into the pores of the sorbent was limiting sorbent utilization. Consequently, additional studies were made under fluidizing conditions selected to promote attrition of the outer sulfated surface as it formed. It was felt that this might provide a continuous method of removing this surface, exposing reactive oxide for further reaction. However, the sulfated surface was found to be harder than the unreacted oxide core. As a result, the fluidized particles decrepitated in their entirety to produce fines of the same composition as the coarse sorbent from which they have formed. To demonstrate high oxide utilization, the use of finely ground sorbent was next evaluated. Using material 100 microns or less, sorbent utilization of 60-80% was obtained under conditions providing nearly complete SO2 removal. This process does not appear to be technically or economically feasible. Costing (1968) about $2/ton coal burned, it leads to a high dust-loading transport reactor with many recycle stages. (Author abstract modified)

5016 APTIC NUMBER 15728

Betta, Vittorio and Francesco Reale
A STUDY ON LIGHT TRANSMISSION OF LAYERS OF DUST PARTICLES AND ON CORRELATIONS TO BE USED IN DISCOLORATION METHODS FOR EFFICIENCY TESTING OF FILTER DEVICES. (Studio della trasparenza di depositi di polveri per le correlazioni nei metodi colorimetrici di misura dell'efficienza di filtrazione). Text in Italian. Termotecnica (Milan), 23(6):295-317, 1969. 3 refs. (Presented at the 23rd National ATI Congress, Bologna, Sept. 24-28, 1968.)

A study of the transparency of deposits of dust is presented, to be used for correlations with colorimetric methods for measuring the effectiveness of air filtration. Theoretical and practical descriptions are presented related to testing the effectiveness of air filters in removing dust particles of various sizes and materials from the air passing through them. The method depends on the measurement of opacity of trapped particles. Experiments are described using aerosols from cement (5-25 microns in diameter); talcum (3 microns); iron oxide (3 microns); and graphite (1 micron).

5017 APTIC NUMBER 14566

Bienstock, D., J. H. Field, and J. G. Myers
PROCESS DEVELOPMENT IN REMOVING SULFUR DIOXIDE FROM HOT FLUE GASES. 1. BENCH-SCALE EXPERIMENTATION. Bureau of Mines, Pittsburgh, Pa., RI 5735, 29p., 1961. 28 refs.

In bench-scale experiments, SO2 in 0.3% concentration was removed completely from a simulated flue gas without cooling the gas by using solids at flue gas temperatures common in power plant practice. A testing program was completed for screening solids for potential absorbents, adsorbents, and oxidation catalysts.

The most active absorbents tested were the oxides of manganese, cobalt, copper, and alkalized alumina. Manganese oxide forms manganese sulfate by absorbing SO2. Upon hydrolysis of the sulfate with NaOH, active manganese oxide is recovered. Electrolysis of the filtrate produces NaOH for re-use in the process and H2SO4, H2, and O2 as by-products. The spent alkalized alumina can be regenerated by reducing with producer gas at 600 C. Effluent gas containing hydrogen sulfide and carbonyl sulfide can be converted to elemental sulfur. After several absorption-regeneration cycles, there was no loss in activity or attrition of absorbent. Activated carbons, impregnated with metallic oxides, can remove SO2 at 130 C. At higher temperatures, oxidation of the carbon occurs. Adsorption of SO2 with molecular sieves is effective with sieves of pore diameters of 13 A. However, absorption is preferred to adsorption in the removal of SO2 from hot gases because of its greater efficiency. A potash-promoted vanadium pentoxide is very effective in converting SO2 to SO3 in the temperature range 300 to 400 C. Practically complete conversion of SO2 was obtained with a simulated flue gas at 365 C and at an hourly space velocity of 1050. Further engineering and cost studies will be undertaken to determine whether removal of SO2 by hot solids is feasible on an industrial scale. (Author conclusions modified)

5019 APTIC NUMBER 15686

Roos, Anton
PROCEDURE FOR DECONTAMINATION OF EXHAUST GASES OF INTERNAL COMBUSTION ENGINES AND MEANS FOR CARRYING OUT THE PROCEDURE. (Verfahren zur Entgiftung der Abgase von Verbrennungsmotoren sowie Mittel zur Durchfuehrung des Verfahrens). Text in German. (Anton Roos, Dillingen Germany). Swiss Pat. 469, 556. 3p. Feb. 15, 1969. (Appl. May 17, 1967, 12 claims).

Preliminary cooled exhaust gas is passed through a pressure valve equipped with openings into a container where it is brought in close contact with a non-foaming lye with a pH of 7. Here the CO2 is absorbed, gaseous combustion residues are oxidized, and the oxidation product is absorbed. Solid particles and mists are precipitated. The gas coming from the container contains only water vapor as the combustible product. The cleaning agent in the container contains, apart from water, calcium oxide, a wetting agent, and hydrogen peroxide. The uncleaned exhaust gas may be cooled by the air flow produced by the vehicle. The openings of the valve are covered by a cap which is lifted by the pressure of the exhaust gases, which can penetrate into the container. The spent lye may be regenerated. In alkaline solution with a layer of caustic lime can also be used.

5018 APTIC NUMBER 15691

Bois, Anthelme
DEVICE FOR PURIFICATION OF HEAT-ENGINE EXHAUST GASES CONTAINING SOLID CONSTITUENTS. (Dispositif d'epuration des gaz d'echappement de moteurs thermiques renfermant des composants solids). Text in French. (Automobiles M. Berliet, Lyon, France) Swiss Pat. 469,900. 3p., March 15, 1969. (Appl. March 21, 1968, 3 claims).

The invention concerns a device for purification of exhaust gas of internal combustion engines which includes a filter made of a refractory fibrous material and a safety valve, incorporated in the exhaust duct of the engine near its exhaust manifold. A typical version of this device consists of a cylindrical heat-resistant metal housing enclosing the filter made, in the form of a coaxial thick-walled hollow cylinder, from about 3 micron diameter and 25 cm long fibers of kaolin wool. The device eliminates the solid constituents of the exhaust gas, particularly of diesel engines where soot originates in the form of 0.1 to 1 micron diameter particles in concentrations ranging between 0.1 and 3 grams per cu m, especially when the fuel/air ratio is high. During operation, the exhaust gas passes through the filter (whose flow resistance is lower than 200 gram per sq cm) from the inside into the radial-clearance space and then through the crenations into the end segment of the housing. Soot retained in the filter is ignited and burned off, at irregular time intervals of up to about 10 minutes duration, whenever the exhaust-gas temperature attains its ignition point, as it does when the engine is operated close to or at full load. Thus, the device is particularly well suited for installation in diesel-powered urban passenger buses.

5020 APTIC NUMBER 16838

Bonio, Richard W., Robert P. Hensel, Richard C. Ulmer, Hilary A. Grabowski, Edwin R. Wilson, and Joseph W. Leonard
FGD CONTROL OF HIGH-TEMPERATURE FIRE-SIDE CORROSION IN UTILITY COAL-FIRED BOILERS. Combustion Engineering, Inc., Windsor, Conn., Research and Product Development, Contract 14-01-0001-485, OCR 869 Rept. 81, 224p., April 25, 1969. 35 refs.

Methods by which coal can be processed to reduce corrosion or damage to fireside surfaces of high-temperature boilers were investigated. Methods for reducing the amount of pollutants were determined. Certain relationships between coal composition and corrosion rates were indicated. Based on the data, the chief constituents affecting corrosion rate are alkalies, alkaline earth metals, iron, and sulfur. The combination of effects of sodium, potassium, alkaline earth metals, and iron made it possible to explain corrosion rates on most of the coals tested. A nomograph was constructed whereby the potential corrosiveness of a given coal can be determined. Also, amounts of neutrality limes and limestones to be added can be established from the nomograph. It also provides a tool by which preparation processes can be modified to reduce the corrosiveness of coal. These results provided the groundwork for a corrosion-reduction study of the entire system of operations, from the seam face where mining begins to the point of loading for shipment. Principle methods of corrosion reduction included analysis of the mining system, coal preparation, and coal additives and blending. To control both sulfur gas emissions and boiler corrosion, it is desirable to maintain an optimum balance between the sulfur level of the coal and the alkaline earth metals retained in the coal or added to the coal. Conventional cleaning using gravity techniques

can remove most of the pyritic sulfur and thereby reduce the total sulfur by 50% or more. Such a reduction greatly reduces the sulfur but increases alkaline earth percentages as well. (Author abstract modified)

5021 APTIC NUMBER 18562

Boswell, Maitland C.
PROCESS FOR SEPARATING SULPHUR DIOXIDE FROM GASEOUS MIXTURES. (Assignee not given.) U. S. Pat. 1,972,074. 3p., Sept. 4, 1934. (Appl. Sept. 8, 1930, 1 claim).

A method was devised for separating sulfur dioxide rapidly and completely even from very dilute mixtures and with the use of a comparatively small quantity of reagent. A liquid reagent or solution of a solid reagent is used with which the sulfur dioxide actually combines but from which it may be readily dissociated by the action of heat. Liquid reagents are the bases of the pyridine, quinoline, isoquinoline, and acridine series and also their hydrogenation products, as well as commercial bases containing them. Cooled sulfur dioxide, preferably freed from dust and sulfur trioxide, is passed through towers or scrubbers containing a prepared reagent at a temperature below 30 C. The exit gases, which contain a small amount of vapor of the base, are passed through a tower or washer where the gas meets a dilute acid to remove the base. At intervals, this acid solution is treated with an inorganic base for the recovery of the organic base. The liquid from the washing tower is run into a heater where it is heated to a temperature of 70-110 C to drive off the sulfur dioxide. The sulfur dioxide then passes into a cooler which traps the small amount of base that escapes with the sulfur dioxide which is separated there. The sulfur dioxide passes to a compressor for collection as a liquid. The base is then pumped back into the washing tower to be reused for the removal of sulfur dioxide.

5022 APTIC NUMBER 15031

Bovier, Ralph P.
SULPHUR-SMOKE REMOVAL SYSTEM. Proc. Am. Power Conf., Vol. 26: 139-144, 1964. (Presented at a Symposium on Air Pollution-Control Aspects.)

A new system for removing fly ash and sulfur dioxide from power plant stack emissions was tested in a pilot plant. Studies were based on the assumption that in full-scale practice a relatively high-sulfur content coal (about 3%) would be used, and that plant capacity would be about 1 million kw. The Sulfur-Smoke Removal System, (flow diagram given), is an adaptation of the contact catalytic process used in the manufacture of sulfuric acid, and consists of the oxidation of SO2 to the trioxide and condensation as sulfuric acid. In this application, the process varies from the conventional acid plant practice in that all sulfur values are removed by the most efficient mist collection system rather than the normal one in which H2SO4 is circulated. Almost 100% of the fly ash is removed by passing the flue gas through a mechanical dust collector after it leaves the boiler, and then through a high-temperature electrostatic precipitator. About 90% of the SO2 is removed and recovered at a concentration of about 70% sulfuric acid. An economic evaluation indicated that the process would meet all requirements of operating and economic feasibility.

5023 APTIC NUMBER 15318

Brand, Hans-Dieter
FUNCTION, APPLICATION, AND ECONOMY OF CATALYTIC COMBUSTION FOR THE MAINTENANCE OF CLEAN AIR. (Luftreinhaltung durch katalytische Verbrennung in Wirkungsweise, Anwendungsmoeglichkeit und Wirtschaftlichkeit). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(10):300-308, 1969.

Most of the air pollutants in stack gases can be oxidized. Through the use of catalysts, the temperature necessary for combustion can be reduced to between 250 and 350 C. Noble metals and metal oxides can be used as catalysts with a metallic or oxide base. They may be spherical or longitudinal, or they may come in perforated plates or wire meshes. Porous catalysts with a large specific surface area can be used for long periods of time. The heat which develops during the process can be utilized in a boiler or if the gases initially came from a drying process, they can be recycled. Cost comparison between the thermal combustion of 10,000 standard cu m stack gas/hr at a temperature of 750 C and the catalytic oxidation of the same amount of gas at 350 C shows that the investment costs are higher for the catalytic plant, but this is compensated by the much lower energy requirement. An example of a plant for the catalytic oxidation of 20,000 standard cu m/hr of stack gas from a petrochemical process with heat utilization shows that operation is quite economical.

5024 APTIC NUMBER 18615

METHOD FOR THE REMOVAL OF SULFUROUS ACID CONTAINED IN WASTE GASES. (Verfahren zur Beseitigung der in Abgasen enthaltenen schwefligen Saeure). Text in German. (Braunschweigische Kohlen-Bergwerke, Helmstedt, Germany) German Pat. 567,135. 1p., Dec. 15, 1932. (Appl. March 18, 1931, 1 claim).

To remove sulfur dioxide from waste gases, the gases are passed over cooled metallic tubes. The water vapors of the flue gas condense causing the formation of aqueous sulfurous acid. At the same time, the alkaline fly ash is deposited on the tubes, thus binding the sulfurous acid. A scraper is used to maintain a certain thickness of the fly ash layer.

5025 APTIC NUMBER 15920

Brink, J. A., Jr., W. F. Burgrabe, and I. F. Greenwell
SEPARATION OF MISTS IN SULFURIC ACID PLANTS. (Separatori di nebbie per impianti di acido solforico). Text in Italian. Riv. Combust., 23(10):481-489, Oct. 1969. 10 refs.

The elimination of mists, sprays, and plumes in sulfuric acid plants is a difficult problem because of the larger use of dark (bituminous) sulfur which has a higher hydrocarbon content than bright sulfur. To control emissions, the ceramic packing at the

tower top was replaced by mist mesh pads and electrostatic precipitators. These were later replaced by fiber mist eliminators. Various types of this device are currently available. Choice is determined by the type of plant and crude charge used. Their high performance is predictable and reproducible. (Author summary modified)

5026 APTIC NUMBER 15370

Brocke, Werner
PROSPECTS FOR PRACTICAL APPLICATION OF DESULFURIZATION PROCESSES. (Aussichten fuer eine praktische Anwendung von Abgasentschwefelungsverfahren). Text in German. Staub, Reinhaltung Luft, 28(3):101-107, 1968. 14 refs.

The principles and first results of various desulfurization processes are discussed. The sulfacid method, based on wet catalytic conversion of SO2 with oxygen and water to sulfuric acid at temperatures below 100 C, was tested on an oil-fired furnace (capacity 1000 to 1500 standard cu m/hr). The catalyst operated successfully for three years without losing its activity. Several smaller plants are now equipped for this type of desulfurization of a gas with an SO2 content of 4 g/std cu m; results showed that this can be reduced to 50 mg/std cu m. The Hitachi method is similar to the sulfacid method with the exception that it tries to avoid a cleaned gas saturated with water vapor. The absorbers in this method are successively loaded, scrubbed, and dried. This permits a combination of wet and dry adsorption. Addition of lime (dolomite) at high temperature to the fuel or injection into the flue gas duct removed 95% of the SO2 in a large boiler plant in the U. S. The 'Grillo' method uses a special combination of metal oxides as absorbent. The loaded absorbent, which contains between 17 and 21% sulfur, can be used in sulfuric acid plants instead of pyrite. The method using alkalized aluminum oxide employed by the U. S. Bureau of Mines is briefly outlined. The ratio of fresh to recirculated catalyst is from 5:1 to 10:1. For 90% removal of SO2, about 42 kg/1000 std cu m regenerated catalyst is required with an uncleaned gas SO2 content of 0.2 to 0.25% by volume. The Monsanto-Penelec, the Mitsubishi, and the Kiyoura-T.I.T. processes are briefly discussed, and a cost estimate table is given for all the methods described.

5027 APTIC NUMBER 13762

Bruton, Robert
EFFECTS OF AIR POLLUTION ON DESIGN OF CARBURETOR DIE CASTINGS. Die Casting Engr., 12(5):30-32, 38, Sept.-Oct. 1968.

To comply with government regulations on automobile exhaust emissions, Rochester Products Div. of General Motors, which makes most of the carburetors used on GM cars, has installed a new computerized emission-control test room. New features, most involving changes in the main zinc alloy die castings, have been designed and built into Rochester carburetors to ensure that they pass the rigid tests applied in the computer facility. Cored holes were added to the 2-jet carburetor zinc bowl casting. Two small cored vertical holes are drilled subsequently to remove flash. They communicate with a long horizontal hole whose diameter is tapped to accommodate the adjustable off-idle unit to be assembled in the bowl. The adjustable off-idle feature helps maintain the correct air to fuel ratio over a critical operating range. An adjustable part-throttle mechanism fitted to the 2-jet carburetor bowl also serves to maintain correct air-to-fuel ratio. An adjustable part-throttle feature is incorporated in the design of the new Monojet carburetor. Vertical holes in the bowl casting are cored, but there is a compound angle hole which must be drilled, reamed, and tapped. The Quadrajet carburetor, now in its fourth year of production, also includes the adjustable part-throttle feature. This carburetor uses a single complex aluminum casting.

5028 APTIC NUMBER 13710

Buckman, F. E. and A. H. Burton
RESIN-IMPREGNATED PAPER FILTERS FOR AIR AND NATURAL GAS. Filtration Separation, 6(4):371-382, 389, July/Aug. 1969. 11 refs.

Resin-impregnated paper was originally conceived as an ideal paper medium for high volume production of oil filters. As a result of developments in specifications and processing, filters now have applications for engine air intake, natural gas, and pilot jet filtration. The medium is characterized by relatively uniform pore size paper, made from cotton linters, or percentage additions of materials such as kraft, rayon, and wool. Consistency in pore size should result in an increased retention efficiency with respect to all but the smallest particles and increased filter stability. Filters are available in an annular pleated form where paper is sealed between plastisol molded end plates and strength is provided by perforated metal inner and/or outer screens or a form where pleat ends are individually sealed and open to air entry on three sides. Here, integral element end plates are not required, since rubber sealing gaskets are incorporated in the air cleaner casing. Pleat form and pleat spacing are controlled to obtain maximum contaminant capacity of the filter. Filter maintenance, correlation between pore size and filter efficiency, and the effects of leaks and fluid velocity on filter efficiency are included in a discussion appended to the article.

5029 APTIC NUMBER 14373

Bump, R. L.
CONDITIONING REFRACTORY FURNACE GASES FOR ELECTROSTATIC PRECIPITATOR APPLICATION. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 23-33. (May 5-8).

Refractory furnaces, unlike boiler systems, discharge high-temperature gases from the final stage of combustion. There is, therefore, a need for a dependable and proven system to handle these gases prior to entering the precipitator. Traditional methods of cooling and scrubbing gases from refractory furnaces involving low-pressure water sprays and inadequate residence time are not satisfactory for use with an electrostatic precipitator. Basically, there are three systems which can be used to

precondition the high-temperature gases: (1) An evaporation cooling tower, which is a separate piece of equipment, may be used. In this case, the furnace design terminates with the last combustion chamber and the tower is installed as a separate piece of equipment. The cooling is done entirely by water; (2) The furnace design may accommodate a combination water-air system. In this scheme, the hot gases are cooled partially by water and partially by air infiltration; (3) The final system is one in which the furnace design is such that the cooling is done entirely with water but in the back end of the furnace, rather than in a separate evaporation cooling tower. A typical installation of each of the three systems is described.

5030 APTIC NUMBER 10677

Burchsted, C. A.
ENVIRONMENTAL PROPERTIES AND INSTALLATION REQUIREMENTS OF HEPA FILTERS. International Atomic Energy Agency, Vienna (Austria), Symp. on Treatment and Control of Airborne Radioactive Wastes, New York City, 1968, p. 175-191, Aug. 1968. 10 refs.

Findings related to the installation, mechanical strength, and the heat, moisture, and corrosion resistance of high-efficiency particulate air (HEPA) filters is discussed. As a result of findings, wood filter units are recommended in preference to steel-cased filter units wherever possible and these should have rabbeted casing joints. The limiting temperature for continuous exposure of HEPA filters to hot air is 400 F. Above this temperature, the tensile strength of the media drops sharply, to as little as 50% of the room-temperature tensile strength at 500 F. The limiting temperature of the assembled filter element is actually determined by the sealant used between the casing and the frame and for wood-cased units, the casing material. Plywood is good for continuous exposure at temperatures up to 300 F for periods up to 48 hrs and up to 200 F for indefinite exposure. Steel is good for any temperature within the useful operating range of the media, although damage may be caused by differential expansion between the casing and the filter pack. Volatilization and reduction in shear strength of adhesives limits continuous operating temperatures to 250-350 F for periods up to 48 hrs and 200-275 F for indefinite exposure. Steel-cased units with special sealants may withstand substantially higher continuous operating temperatures but in most cases are unable to meet the requirements for fire and hot air. Resistance of the filter element to flexure, vibration damage, working of casing joints, gasket relaxation, and casing damage under abnormal pressure loadings is in large part a function of the mounting frame or fixture in which the filter is installed. Critical aspects of mounting frame and fixture design are structural rigidity, the method of joining individual frame members and the method of sealing the frame or fixture into the filter housing. It is also a function of the tolerances on dimensions, flatness, alignment, and surface finish of gasket sealing surfaces, rigidity of filter clamping devices, and uniformity and degree of compression of filter gaskets in the frame or fixture. (Author abstract modified)

5031 APTIC NUMBER 10823

Canzoneri, Nicholas
METHOD OF MAKING AN AIR FILTER. (Assignee not given.) U. S. Pat. 3,460,321. 7p., Aug. 12, 1969. 15 refs. (Appl. Sept. 27, 1967, 8 claims).

The invention relates to methods of making reusable air filters from the fibers of gourd-like loofah fruit. Loofah fiber possesses definite advantages over various materials used previously as air filter media. These include economy in original cost, ease of handling and shaping the fiber, and absence of special treatment requirements. A loofah skeleton is slit open, dried and compressed to a flexible thin layer, supplied with a marginal binding, and then returned to its original porous conditioning by moistening. After drying, the filter is ready for use. Density and number of filter layers depend on the medium's filtration function. Loofah filters are highly efficient, lightweight, and suitable for use in air conditioning, heating, and automobile air intake and silencer systems.

5032 APTIC NUMBER 15696

Carrison, Par Bilmar
AN APPARATUS FOR REMOVING SULFUR DIOXIDE IN FLUE GAS. (Endo gasu kara nisanka iou o tokyo suru sochi). Text in Japanese (Air Preheater Co. Inc., Wellsville, N. Y.) Japanese Pat. Sho 44-13003. 6p., June 11, 1969. (Appl. June 22, 1965, claims not given).

An apparatus is described for desulfurizing exhaust gas by oxidizing sulfur dioxide, regenerating the catalyst, eliminating the catalyst that was not regenerated, and adding new catalyst. A reaction chamber contains a porous catalyst and consists of a cylindrical outer housing which has entrances and outlets for exhaust and regeneration gas in the axial direction. The housing covers the entire reaction and catalyst rooms, and is divided into upper and lower rooms. The catalyst room is divided into twelve semicircular rooms by radial walls. The catalyst in some of these rooms is regenerated by hot gas; other rooms are used for oxidizing sulfur oxide in the exhaust gas. The catalyst room moves on its axis, and can desulfurize the exhaust gas and regenerate the catalyst successively. Each semicircular catalyst room is divided into several parts by concentric cylinders; half of them contain oxidation catalysts such as vanadium pentoxide, and others are used as a guide vane for passing the exhaust gas through the catalyst effectively and easily. When the catalyst is no longer used for regeneration, the bottom of the room for regeneration is disconnected and the waste catalyst falls down. When the old catalyst is removed, new catalyst is added. Thus the present process does not discontinue the desulfurization of the exhaust gas. Regeneration gas is preliminarily heated to a desirable temperature (for vanadium pentoxide, 371.1 to 398.9 C), and used for initially warming the catalyst. After regenerating the catalyst, the gas passed the same route as the exhaust gas from the combustion furnace, and is desulfurized. The sulfur trioxide thus produced reacts with steam in the exhaust gas, and becomes sulfuric acid at lower temperatures.

5033

APTIC NUMBER 15636

SYNTHETIC MATERIALS FOR AIR FILTERS - A SUCCESS? (Synthetische Werkstoffe fuer Luftfilter - ein Erfolg?). Text in German. Chem. Ind. (Duesseldorf), 21(10):678-679, Oct. 1969.

The insensitivity of synthetic fibers to most chemicals, their hydrophobic properties, and their low cost have made synthetic fibers the preferred filter medium. Air filter packs come in two types, throw away packs and those which can be regenerated. For separation of the finest dusts, the throw away packs are usually used since regeneration would reduce their lifetime and make them expensive. The development of these filters is considered a success. In contrast, filter frames or casings made of polymers have not been very successful. Since the filter frames are mostly manufactured by sheet steel processing plants, the switch to polymers for this application has been slow. No mass production has begun, making the price for such frames or casings high. The chemical industry is nevertheless willing to pay the high price. A certain limit is imposed on these synthetic air filters by operating temperatures above 80 C; most polymers are unable to withstand higher temperatures.

5034

APTIC NUMBER 15201

Clark, William T.
DESIGN OF A LARGE MUNICIPAL INCINERATOR. Preprint, Air Pollution Control Assoc., South Atlantic Section, 11p., Nov. 19, 1968.

Design specifications for a municipal incinerator in the District of Columbia were derived from studies of the effects of such furnace variables as temperature, excess air, fuel bed agitation, and incomplete combustion in the generation of contaminants. To achieve necessary control of incinerator operations, a new furnace configuration was developed. This configuration is directed toward obtaining uniform gas velocity patterns, uniform temperatures, longer gas retention time, and less entrainment of particulates in the flue gas stream. A combination of cyclones and electrostatic precipitators was chosen to control flue gas temperature and avoid condensation corrosion. By collecting large fatty acids, the cyclones will reduce fouling of the precipitator's collector plates. Specifications call for a minimum 95% precipitator efficiency. The plant will process 1500 tons of refuse per 24 hrs. It contains shredding equipment for large bulky refuse, metal separation equipment on the shredder discharge, and laboratory facilities for testing different facets of solid waste disposal. One of the six furnaces is fully instrumented to obtain air flow and flue gas data and to measure furnace temperatures. Particulate and gaseous incinerator flue gas constituents are tabulated.

5035

APTIC NUMBER 15807

Cole, Robert and H. L. Shulman
ABSORBING SULFUR DIOXIDE ON DRY ION EXCHANGE RESINS....FOR REDUCING AIR POLLUTION. Ind. Eng. Chem., 52(10):860, Oct. 1960. 8 refs. (Presented before the Div. of Petroleum Chemistry, American Chemical Society, 138th Meeting, New York, Sept. 1960.)

Ion exchange resins, because of their porous nature, have a potential application as adsorbents in gas-solid systems for the removal of sulfur dioxide from waste gas streams. Experimental studies to determine the adsorptive capacity - temperature characteristics of dry ion exchange resins in contact with air-sulfur dioxide mixtures are described. Comparative adsorption data obtained for IRA-400 and -410 chloride form resins, Dowex 50 and IRC-50 hydrogen form resins, and Dowex 2 chloride and hydroxyl form resins indicated that adsorptive capacity depends upon the type of base group. Isosteric heats of adsorption were obtained from reference substance plots. Comparisons between the absorptive capacity of the resins studied and silica gel, gas-adsorbent carbon, and molecular sieves were made. From the standpoint of adsorption capacity and volume of sulfur dioxide desorbed, IRA-400 performed best. From the standpoint of ability to adsorb large quantities at extremely low concentrations, however, the molecular sieves appear to be far superior. The comparison is based on the assumption that at 100 C and low concentrations, the adsorption and desorption curves are identical.

5036

APTIC NUMBER 18801

Constantinescu, Mircea, Eugenia Platon, and Olga Tibrea
PROCEDURE FOR ELIMINATING OXIDES OF NITROGEN FROM GASES USED IN AMMONIA SYNTHESIS. (Procedeu de eliminare a oxizilor de azot din gazele folosite la sinteza amoniacului). Text in Romanian. (Ministry of Chemical Industries, Bucharest) Socialist Republic of Romania Pat. 50557. 2p., Feb. 26, 1968. 1 ref. (Appl. March 18, 1967, 1 claim).

The patented improvement consists of adding 5-60 mg/l sodium dichromate to the wash water, one advantage thus offered being the oxidation of NO to NO2 and N2O3, which then dissolve more readily in the wash water instead of escaping into the air.

5037

APTIC NUMBER 13767

Corbett, P. F. and R. F. Littlejohn
REMOVAL OF SULPHUR OXIDES FROM FLUE GASES. Brit. Coal Util. Res. Assoc. Monthly Bull., 16(10):437-488, Oct. 1952. 53 refs.

Electric power stations represent a case where the treatment of flue gas to remove SO2 appears practical because of the large amounts of coal used. A number of suggestions have been made for reducing SO2 to sulfur, but the SO2 must first be removed and recovered from the flue gases. The catalytic oxidation of SO2 to form sulfuric acid has also been suggested. Other methods are the absorption of SO2 in an aqueous solution of an alkali or alkaline formate, scrubbing the gases by calcium polysulfite in the presence of a catalyst to give a polythionate, and the absorption of sulfur-containing gases in an alkaline solution of sea salt and its subsequent electrolysis. The neutralization of SO2 by ammonia has received much attention because the sulfur is recovered in a marketable form. The two best known gas washing processes are those originally installed at the Battersea and

Fulham power stations. The Battersea plant was designed to remove 95% of the SO2 in flue gases from coals whose average sulfur content was 0.8 to 0.9%. It was based on the catalytic oxidation of SO2 in an aqueous solution followed by neutralization of the resultant sulfuric acid. Fulham adopted a closed cycle process based on the production of calcium sulfate. However, even if all power stations developed processes for recovering SO2, only a small percentage of the SO2 in the atmosphere would be removed because of the many other sources of this pollutant.

5038 APTIC NUMBER 15737

PROCEDURE FOR RECOVERY OF ELEMENTAL SULFUR FROM GASES CONTAINING SULFUR DIOXIDE. (Procedimento per il ricupero di zolfo elementare da gas contenenti an'dride solforosa). Text in Italian. (Corrado Perrante, Aosta, Italy) Italian Pat. 612812. 3p., April 1967. (Appl. June 4, 1965, 6 claims).

Gases containing sulfur compounds are blown over a layer of red-hot carbon in a gasogene, are mingled with an additional amount of sulfur-bearing gas, and after passing over a catalyst in a tower are sent to a condenser for recovery of the sulfur. Sulfur dioxide reacts chemically with the carbon to form a combination of carbon monoxide, carbon dioxide, and elemental sulfur. The reaction is exothermic; once properly started it very nearly maintains itself at the proper temperature. A suitable catalyst is bauxite, iron oxide, or calcium sulfate. If the gas used does not contain any free oxygen, a certain amount must be mixed with the gas to maintain the combustion necessary to keep the carbon of the gasogene at the proper temperature. An electric current can be used for this purpose.

5039 APTIC NUMBER 15560

Council for Scientific and Industrial Research, Pretoria (South Africa), Air Pollution Research Group
HOW TO OBTAIN HIGH STEAMING RATES FROM VERTICAL BOILERS FIRED WITH ANTHRACITE. CSIR Res. Rept. 249, 8p., 1966.

Simple modifications were made in a vertical boiler installation in an effort to determine whether a high steaming rate was possible using anthracite instead of bituminous coal with the object of reducing smoke production. A complete energy balance for the boiler was obtained. Using bituminous coal in the experimental boiler, the steaming rate achieved by an experienced stoker was 14% more than that achieved by an inexperienced man. When anthracite coal was used and the stoker was the same inexperienced man, the stack gas flow dropped by 51%, and the steaming rate dropped by 25%. When a forced draught was used with anthracite to bring the stack-gas flow to about the same as it was when bituminous coal was used, the steaming rate was 56% higher than when anthracite was used without a forced draught and 17% higher than when bituminous coal was used. The highest efficiency was obtained when anthracite was used with a natural draught. The flow rate of gases through the boiler is such that some combustion takes place in the stack, thus causing a heat loss. Worthwhile savings could be achieved if a simple economizer were installed above the boiler. This boiler can be applied in industry if the draught is increased so as to make the stack-gas flow rate approximately the same as when bituminous coal is used.

5040 APTIC NUMBER 18366

Cross, F. L., Jr. and P. W. Ross
EFFLUENT WATER FROM INCINERATOR FLUE-GAS SCRUBBERS. American Society of Mechanical Engineers New York Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 69-72. 6 refs. (May 5-8).

Florida's new air pollution control standards for incinerator emissions has focused attention on the use of dry control methods, such as bag houses or electrostatic precipitators to replace the conventional wet-scrubbing systems now used in large municipal incinerators. Although wet scrubbers reduce emissions to 0.1 - 0.2 g/cu ft, dry control methods can reduce these limits even further. Other problems caused by the use of scrubbers on incinerators involve high corrosivity of the scrubber effluent and inability of the effluent to meet Florida's criteria for water pollution control. In order to meet water quality standards, scrubber water must be treated to neutralize excess acidity and to remove chemical constituents before it can be released to a receiving stream or lake. Analyses of scrubber water at various installations showed a marked increase in chemical constituents in effluent over amounts found in raw water pumped from wells to supply the air pollution devices at the incinerator. Phenols and cyanide showed the largest increase in proportion to the amount found in the raw water, while aluminum, barium, chromium, copper, iron, lead, manganese, and zinc all showed increases over the raw water counts. It is suggested that the cost of dry control methods may not be as high as scrubber waste water treatment.

5041 APTIC NUMBER 13746

Daniels, Farrington, William G. Hendrickson, and Elton Gordon Foster
NITRIC OXIDE RECOVERY SYSTEM. (Wisconsin Alumni Research Foundation, Madison). U. S. Pat. 2,578,678. 14p., Dec. 18, 1951. 13 refs. (Appl. Mar. 28, 1949, 18 claims).

A process for the recovery of nitrogen oxides from gaseous mixtures is presented. The nitrogen oxide-containing gas is first cooled and then dried by passing it through a body, shower, stream, layer, or bed of solid adsorbent having a preferential adsorbability toward water, and the dried gas is then contacted with a catalyst mass having the function of accelerating oxidation of the nitric oxide content of the gas mixture to nitrogen dioxide. The dry gas mixture is contacted with particles of a solid adsorbent, such as silica gel, which separates nitrogen dioxide from the other components of the gas mixture. Adsorbed nitrogen dioxide is de-sorbed by circulating hot nitrogen dioxide through and in direct contact with the solid adsorbent material. The remaining adsorbed NO2 is flushed out by means of hot dry air contacted with the solid adsorbent. When

NO2 is to be converted to HNO3, oxygen-containing air is used, and when the NO2 is to be liquified, hot dry CO2 or nitrogen can be used.

5042 APTIC NUMBER 15671

Davies, W. and W. T. Crosby
THE CONTROL OF FUME FROM ELECTRIC ARC FURNACES. J. Iron Steel Inst. (London), 201(2):110-112, Feb. 1963.

The problems associated with fume emission from electric-arc steelmaking furnaces are grouped into three categories: containment of the fume from its carrier gas within a duct, the separation of the solid and/or liquid particles from the gas, and the disposal of the collected material. Two techniques for controlling the fumes are the sharp-roof collection system and the close-fitting hood system. The former relies on thermal currents to carry fumes to the roof trusses where hoods receive the fumes and discharge it to the atmosphere or a gas cleaning plant. The latter employs one or more hoods fitted adjacent to the furnace roof, doors, and pouring spout to discharge fume into ducts, rather than into the shop atmosphere. The shop roof collection system leads to serious difficulties in implementing the Clean Air Act; the close-fitting system increases the intensity of flame production. These and other problems are overcome by the direct extraction method in which a vacuum is created in a furnace to exhaust fumes directly from a duct in the furnace roof or wall. The advantages of this method are complete clearance of fumes associated with high oxygen lancing rates, low exhaust volumes, complete control of furnace pressure, unimpaired steel quality, and minimum maintenance requirements. While its efficient operation requires the treatment of gases released during phases of heat and a combustion/cooling chamber, direct extraction equipment effectively facilitates fume control and compliance with emission standards.

5043 APTIC NUMBER 18818

Dean, Karl C., Richard Havens, and Kimball T. Harper
CHEMICAL AND VEGETATIVE STABILIZATION OF A NEVADA COPPER PORPHYRY MILL TAILING. Bureau of Mines, Washington, D. C., RI-7261, 14p., May 1969. 2 refs.
PB-184515

Population encroachment on formerly isolated sites of mine, mill, and smelter wastes increases the importance of controlling air and water pollution derived from natural weathering of such wastes. Use or stabilization of these wastes comprises the only practical means for minimizing pollution. The Bureau of Mines stabilized 10 acres of windblown copper mill tailings at McGill, Nev., by a combination chemical-vegetative procedure. Legumes, winter wheat, wheatgrasses, and wild rye were seeded, and the area was subsequently sprayed with a resinous adhesive chemical to stabilize the sands until the vegetation could grow. During the year since treatment, the area has been well stabilized against wind erosion. The established vegetation appears to be capable of self-perpetuation and renewal without irrigation. The cost of stabilizing the area was $135.50 (1969) per acre. (Author abstract modified)

5044 APTIC NUMBER 14789

Dembeck, Hermann
DECYANIZATION OF GAS SCRUBBER WATERS. (Entcyanisierung von Gaswaschwaessern). Text in German. Part I. Wasser Luft Betrieb, 12(8):459-463, 1968. 18 refs. Part II. Ibid, 12(9):552-558, 1968. 12 refs.

Differing cyanide concentrations and otherwise different compositions of gas scrubbing water from metallurgical plants, coking plants, and gas works are discussed. In metallurgical plants, the cyanide concentrations range from 1 to 10 mg/l; in coking plants they range from 5.2 to 75 mg/l; and in gas works, they range from 2 to 15 mg/l. Scrubbing waters from metallurgical plants are generally less toxic than the others, which have higher concentrations of sulfur compounds, ammonia, and phenols. There are physical, chemical, and biological decyanization processes. The method of driving off the cyanide compounds by aeration and addition of acids to reduce the pH is a physical process whose efficiency rises with increasing temperature, decreasing pH, and increasing air to water ratio. Thermal decomposition of the cyanide compounds (evaporation) also falls into this category. The chemical decyanization processes are direct oxidation (dissociation with formation of cyanates or nitrogen and carbon dioxide), catalytic oxidation in packed columns, precipitation method (conversion of toxic cyanides into cyanide complexes by solar radiation and further conversion to iron cyanoferrates which can be separated), and finally the polyphosphate method (a hydrolytic process speeded by the addition of polyphosphates). Of the biological processes, packed columns with biological flora and the activated sludge method were found to be suitable methods.

5045 APTIC NUMBER 14609

DePalma, T. V. and M. W. Perna
DIESEL ENGINE POLLUTANTS. PART II. CONTROL. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 221-234.

A catalytic system to control diesel engine pollutants is discussed. Catalytic oxidation of pollutants to carbon dioxide and water is the most desirable method to use. Several catalysts accomplished the task of odor improvement and reduction of gaseous combustibles; these are made of spherical alumina-base materials, one of which contains a noble metal. The real advantage to the solution of the environmental pollution problem by catalysis is its operational persistence. It not only oxidizes odorous oxygenates but also efficiently consumes other combustibles such as carbon monoxide and hydrocarbons. Converter and catalyst design criteria are based on maximum throughput from the engine. Space and mass velocity are selected to give high pollutant

conversion even with maximum exhaust gas output. Gas flow distribution must be controlled so that catalyst utilization is complete. This is accomplished by designing low pressure drop beds, minimizing head losses, and balancing velocity and static heads within the converter. The design problem becomes critical when one understands that an exhaust pollution control system must operate under a very wide range of conditions. Engine characteristics also affect the performance of a catalytic system. The two-stroke diesel engine, when compared to the four-stroke engine, exhausts a greater volume of gases which are lower in temperature and more dilute. These conditions diminish the reaction rate for oxidation and make conversion of pollutants more difficult. System design changes in the inlet screen have eliminated the sooting of the catalyst in that area. The need for rapid and accurate evaluation of exhaust gas odorants is obvious. From the catalyst development standpoint an accurate appraisal method is necessary in order to demonstrate subtle differences in performance. A catalytic system was developed which reduces odor emissions from diesel powered vehicles, which oxidizes hydrocarbons and carbon monoxide with high efficiency, and which can be fitted into existing muffler spaces.

5046 APTIC NUMBER 14527

METHOD FOR THE REMOVAL OF SULFUR OXIDES FROM GASES. (Werkwijze voor de verwijdering van zwaveloxyden uit gassen). Text in Dutch. (Dept. of Interior, Washington, D. C.) Dutch Pat. 6,800,289. 7p., July 19, 1968. (Appl. Jan. 9, 1968, 7 claims).

An economical and efficient method is proposed to remove sulfur dioxide from combustion gases. This consists of catalytic oxidation of SO2 to SO3. The SO3 formed and the moisture in the combustion gas are allowed to react with a tricalcium phosphate-containing material to form a valuable fertilizer. Hot combustion gases from a conventional oven are diverted to a cyclone separator or electrostatic precipitator to remove the solid materials. In the first stage, the hot gas goes to an oxidation zone filled with an oxidation catalyst such as V2O5 with K2O as promoter or an iron oxide or platinum catalyst. The gas is allowed to rise in a pipe and come into contact with falling particles of tricalcium phosphate. Contact can also be achieved with a fluidized bed system. The basic reaction in the contact zone is as follows: Ca3(PO4)2 plus 2H2SO4 plus 4H2O yields CaH4(PO4)2 plus 2CaSO4.2H2O. Gases leaving the contact zone come into a separator to remove solid materials. A heat exchanger is used to cool the gases after separation of solids from 800-500 C to 125-150 C before they enter the chimney.

5047 APTIC NUMBER 14723

Derndinger, Hans-Otto
MOTOR VEHICLE ENGINES. (Kraftfahrzeugmotoren). Text in German. VDI (Ver. Dsut. Ingr.) Z. (Duesseldorf), 110(21):978-982, July 1968. 8 refs.

Recent developments in the field of exhaust gas cleaning are discussed. Since the passage of laws in the U. S. A. limiting the concentrations of carbon monoxide and of unburned hydrocarbons in the engine exhausts, automobile manufacturers have developed various methods of meeting these legal requirements. Most of them are based on the principle of afterburning, e.g., manifold air oxidation and thermal reactors. The Clean Air Package aims at accurate adjustment of the carburetor and delays the ignition, guaranteeing a more complete combustion, although the exit gases have higher temperatures. Another method is gasoline injection. The effects of these measures are beginning to be felt. In Los Angeles, the steep increase in hydrocarbon emissions has been reversed. Great efforts are being made to reduce the emissions by 1980 to the 1960 level. To achieve this end, further measures are required. Control measures tend toward a smaller ratio of combustion chamber surface to combustion chamber volume. Careful sealing will eliminate the emission of unburned hydrocarbons from the fuel tank evaporation. The two toxicants which have received little attention to date by legislators are lead and nitrogen oxides. In conclusion, the marketing of two new Wankel engines is mentioned.

5048 APTIC NUMBER 15418

HOT GAS ENGINE REVIVAL. Design Components Eng., no. 2:10-13, Jan. 15, 1969.

A description of the hot gas engine used to decrease air pollution by diesel fumes is presented as developed by the Philips Research Laboratories at Eindhoven in Holland. All hot gas engines depend on compressing a gas at high temperature and expanding it to a low temperature, allowing the gas to do work on a piston. Heat is conserved within the engine by incorporating a heat exchanger between the permanently hot chamber and the permanently cold chamber. The regenerator receives heat from the media during expansion and returns it to the media during recompression, when the gas is again pushed back into the hot chamber. Most of the multi-cylinder engines are based on work carried out on single-cylinder units. The invention of the rhombic drive enabled the use of the out-of-phase layout and obviated the need for the pressurized crankcase. It consists of a geometric shape enclosed by the piston rod yoke and displacer rod yoke, and their associated connecting rods at any position during the engine cycle. The working gas is maintained at high pressure by an ancilliary pump which serves to vary the mean effective pressure within the cylinder and the power developed by the engine. A cylinder burner air preheater shrouds the nest of heater tubes during engine operation. The 'roll-sock' seal is used to seal the piston rod and prevent oil from entering the cylinder from the crankcase. Analyses carried out on the burner exhaust gases revealed the following: 1-2 ppm of unburnt hydrocarbons, 0.007-0.03% carbon monoxide, and 100-200 ppm nitrogen oxides.

5049 APTIC NUMBER 14535

Diehl, F. F.
AIR POLLUTION RESEARCH IN GERMANY AND GREAT BRITAIN AS OBSERVED DURING OCTOBER 1967 VISITS. Bituminous Coal Research, Inc., Monroeville, Pa., 19p., Nov. 1967.

The highlights of a trip to West Germany and Great Britain in October 1967, to survey methods and investigations of sulfur dioxide control, are reported, including a summary of coal research activities. The average sulfur content of the coals abroad - 1.5% in Germany and 2% in Britain - makes the control of SO2 emission less of a problem than in the United States. Regulations concerning SO2 are based upon ambient air quality, permitting the emitter several alternatives by which to conform. Current research in Germany on SO2 control is concentrated mainly on limestone or dolomite addition in a dry system, and on the development of active carbons and chars for the dry adsorption of SO2 from flue gases. Some sizable pilot plants are in operation or are being erected. All plants whose operation results in pollutant emissions must be licensed by the Ministry of Health and must demonstrate continuing compliance with control regulations. Pollution considerations have an affect on plant location, which in turn significantly affects plant costs. In Britain, smoke and particulate control over the past decade has done much to improve the air pollution situation; ambient concentrations of SO2 are slowly declining in spite of a steady increase in the total SO2 emitted from larger power plants. Tall, multiple-flue stacks are given credit for this changing situation. Consequently, SO2 control for the sake of clean air is not currently a major subject for research in Britain; rather, the prime goal of pilot scale studies on a variation of the alkalized-alumina process is the production of sulfur, with lowered SO2 emission considered a by-product. The target concentration of SO2 in ambient air is 0.35 ppm, considered acceptable by medical researchers. Investigations of the synergistic effects of SO2 and smoke are being emphasized. It seems apparent that future coal use will be on a 'controlled decline' and will be kept alive strictly on a 'national economy basis. A future power policy for Great Britain is being formulated, taking into consideration the discovery of natural gas in the North Sea. Some specific research activities of various private and governmental organizations in West Germany and Great Britain, and one in Holland, are briefly described.

5050 APTIC NUMBER 14787

Dorman, M. G.
THE SODIUM FLAME APPARATUS IN SORTING AND RESEARCH TESTS OF AIR FILTERS. Filtration Separation (Purley), 6(5):499-501, 503, Sept./Oct. 1969. 3 refs.

The sodium flame test, in which a heterodisperse test cloud of common salt is formed by the evaporation of a spray from an aqueous solution, is described; the particles are approximately cubical and are mainly smaller than 1 micron, with a mass median size of 0.7 micron. The apparatus has proved of great value for the rapid testing of air conditioning and respirator filters of both low and high efficiency. It has also been found useful in research on the penetration of very small particles, in measuring the effect of electric charge on filtration, and in high-temperature studies; some individual research problems are described. For example, the penetration of very small highly-toxic particles, such as radioactive material or viruses, through high-efficiency filters was studied; it was proved that such filters are suitable for removal of particles of less than 0.1 micron at low air velocities, penetration being less than with either the standard sodium chloride or dioctyl phthalate (D.O.P.) clouds. In another investigation, salt particles were charged with a Whitby ion generator, filtered, and penetration measured by the flame photometer. Results showed that with increasing charge, penetration through fibrous filters decreases, but when particles are sensibly neutral, penetration is greater than with the normal cloud; the effect is greater on charged-fiber filters. To assess the variation in efficiency of high-efficiency glass fiber paper with temperature, the laboratory scale apparatus 10-100 l/min flow) was used and showed that such paper, if of good quality, is efficient at 400 C and suffered no damage from the high temperature. Tests at higher temperatures are probably feasible with sodium salts of lower vapor pressure.

5051 APTIC NUMBER 14578

Dratwa, Heinrich
BINDING THE AVR OF SULFUR OXIDES - PROBLEMS AND POSSIBILITIES. (Die Reinhaltung der Luft von Schwefeloxiden - Problematik und Moeglichkeiten). Text in German. Tech. Ueberwach. (Duesseldorf), 8(5):153-157, May 1967. 40 refs.

Sulfur dioxide tops the list of emitted toxic gases. In the Ruhr valley alone, 36% of the total quantity of gases emitted to the atmosphere consists of SO2. Statistics based on fuel consumption show that industry contributes 80.2% and domestic heating 19.8%. Extensive measurements confirmed these data. It was found that power plants emit 38%, industrial plants 41%, and domestic heaters 21%. These emissions are particularly damaging to plants, while sporadic cases of injury to humans and animals have become known. In the Federal Republic of Germany, maximum allowable concentrations have been legally set which must not be exceeded even temporarily. Fuel oils are frequently desulfurized prior to use. Coal contains organically bound sulfur (about 0.6 to 0.9% by weight) and inorganically bound sulfur (can reach 5% by weight). Regulations exist in West Germany which require switching to low-sulfur fuels during inversion weather. Construction of high stacks might be of help in single industrial complexes in the open country. Another way to avoid SO2 emission and corrosion of heating surfaces is the use of additives such as dolomite, magnesium oxide, limestone or oxidizing catalysts. Still another way is the removal of sulfur dioxide from the waste gas by absorption or adsorption. There are several ways to do this. The first is to dissolve the sulfur dioxide in special solvents or in water, but this process is uneconomical up to concentrations of 10% by volume. The second method is to dissolve substances in water which bind SO2 or SO3 chemically. Generally, it can be said about these methods have not been successful, and there is a preference for SO2 adsorption on activated charcoal or low-temperature coke.

5052 APTIC NUMBER 14985

Dratwa, Heinrich
THE [illegible], A PROCESS FOR ODOR ELIMINATION - PRINCIPLES

OF OPERATION AND APPLICATION POTENTIAL. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(12): 19-24, Dec. 1968. 16 refs.

The biofilter is an automatic self-regenerator air-cleaning system for successfully eliminating odors of organic origin. This method, which is comparatively inexpensive, is based on biological decomposition. A biofilter mat is a pretreated gas-permeable carrier substance on which bacterial strains are applied in large concentration together with special mixtures of vital substances. Gas throughput is limited so that enrichment of the odorous substances in the filter substrate will not exceed the rate of decomposition by bacterial activity. When waste air flows through the filter mat, odorous substances are first retained by sorption processes: absorption due to the large internal surface of the bulk material and absorption by the water present in the material. In a second stage, the bound odorous substances are 'ingested' by the surrounding microorganisms. The biofilter is most extensively used in the agricultural sector. It is also used in food plants and cadaver processing plants. The service life of the filter is unlimited, provided that the waste gas does not contain impurities having a direct or indirect toxic effect on the microbes.

5053 APTIC NUMBER 10784

Dudley, R. P.
NOW CONTROL OVER SO2 EMISSION REDUCES AIR CONTAMINATION. Chem. Eng. Progr., 53(3):158-156, March 1957.

The SO2 contamination reduction program initiated by the Humble Oil and Refining Company is discussed. Black 98% sulfuric acid was used as a catalyst at the alkylation plant. It was also used as a treating agent for lube distillates, lube residuum, and aromatic solvent. From each of these operations a spent acid was produced, and a portion of it was used to treat gasoline, heating oil, and solvents. Spent acids from these operations, together with the excess spent alkylation acid and the spent acids from treatment of lube distillates, were processed to recover as much of the contained acid as possible. About 55% of the fortified acid charged to the refinery was recovered as concentrated acid. The rest was decomposed to SO2 and released to the atmosphere. To substantially reduce SO2 emission, an acid regeneration process, in which the H2SO4 in a spent acid is decomposed to SO2 and then reconverted in a contact acid plant, was developed. To reduce H2S emission, a sulfur recovery plant was constructed along with an amine-scrubbing unit.

5054 APTIC NUMBER 10333

Dwyer, F. G.
CATALYST SYSTEM MORPHOLOGY AND DESIGN. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia., Pa., Nov. 1968, p. 73-86. 13 refs.

Common gaseous pollutants that are amenable to catalytic transformation are discussed. Sulfur dioxide is eliminated by catalytic hydrodesulfurization, oxidation with a vanadium pentoxide catalyst, or reduction with carbon monoxide in flue gases. Nitrogen oxides are eliminated by reduction with chromite and copper oxide catalysts, which lose their effectiveness. Carbon monoxide is removed from atmospheric gases by catalytic oxidation. More is known about the mechanism of CO oxidation, which is catalyzed by transition metal oxides and noble catalysts, than about any other methods. Carbon monoxide also can be oxidized in the presence of H2 over MnO2, and indium doped ZnO, based on electronic charge transfer. Mechanisms for the oxidation of hydrocarbons are similar to those for CO oxidation but more catalyst efficiency. Interaction of gaseous pollutants presents a problem in finding the right catalyst. The complexity of the problem is seen in the exhaust from internal combustion engines. Here, CO and unburned hydrocarbons are converted by catalytic oxidation and nitrogen oxides are converted by catalytic reduction. The transition metal oxide and noble metal catalysts must be supported on a base for ease of handling, cost, and thermal stability. Problems encountered in treating industrial gas streams are those of dilution. A further complication arises if the diluent interferes in some manner with the reaction being catalyzed. Poisoning effects, which are present in all heterogeneous catalytic reactions, must also be considered. Although none of the catalysts is a panacea, each brings the solution of air pollution closer.

5055 APTIC NUMBER 15321

Eberan-Eberhorst, P.
FORWARD-LOOKING EXHAUST GAS RESEARCH FOR THE AUTOMOTIVE PETROL ENGINE. (Abgasforschung zukunftsweisend fuer den Fahrzeug-Otto-motor). Text in German. Motortech. Z. (Stuttgart), 30(9):315-323, Sept. 1969. 18 refs.

The influence of engine operation modification on the emission of such exhaust gas components as CO, hydrocarbons and nitrogen oxides is discussed. The use of an evaporator helps reduce carbon monoxide emission to the lowest possible concentration. A spinning motion in the air intake pipe also reduces the CO content. The type of carburetion has almost no effect on the CO or hydrocarbon emission. Study of the influence of temperature cooling agent on hydrocarbon emission showed that emission could be considerably reduced by raising the temperature of the agent. When the engine acts as a brake, hydrocarbon emissions jump to high concentrations due to misfiring. Spiral-like intake pipes or vortex-imparting installations in the intake system, tangential inlets or deflector valves have a considerable influence on hydrocarbon emission, which is decreased because the wall layer is completely burned due to the higher turbulence. This however, costs power. Compression of the intake air and spark timing also reduce these emissions. With a commonly used idling mixture containing 3% CO, the hydrocarbon emissions of a 1-liter four cylinder engine were reduced from 1720 ppm at 30 degree ignition advance to 180 ppm at 18 degree ignition delay. The emission of nitrogen oxides can be reduced by exhaust gas return to the fresh air which reduces the caloric value of the fuel/air mixture and by water injection into the intake pipe. Tests with the latter method showed that

nitrogen oxide emissions could be reduced from 2000 ppm to 583 ppm. At lamda equal to one, a 20% addition of exhaust gas has the same effect as water injection at a water to fuel ratio of 1:2.

5056 APTIC NUMBER 14369

Eberhardt, H. and W. Mayer
EXPERIENCES WITH REFUSE INCINERATORS IN EUROPE, PREVENTION OF AIR AND WATER POLLUTION, OPERATION OF REFUSE INCINERATION PLANTS COMBINED WITH STEAM BOILERS, DESIGN AND PLANNING. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 73-86. 7 refs. (May 5-8).

European steam generators with refuse firing must meet a number of stringent legal requirements for environmental control. In Germany, the dust emission of refuse incineration plants with a refuse throughput of more than 20 tons refuse/day may not exceed 150 mg dust/cu Nm clean gas referred to 7% CO2 at any time. Depending on the preload of the site environment, this value must still be lowered so as to remain within the emission limits of 0.42 g/sq m/day for the annual mean and 0.65 g/sq m/day for the monthly mean. Flue dust collectors have over 98% efficiency. Difficult physical and chemical problems with the fuel and with boiler availability are met by attention to many engineering details. While the analysis of residential refuse is a relatively simple procedure, the determination of the volume and composition of industrial refuse is especially difficult and contributes in large part to the difficulties in planning and design of incineration plants. In Europe, refuse incinerators are combined with steam boilers, and operation of these large plants has shown that boilers with refuse fire chambers including the accessory equipment differ fundamentally from conventional plants in design and operation. The paper considers these plants in detail and compares them with plants operating with fossil fuels. It is shown that corrosion of boiler and superheater tubes is largely prevented by maintaining oxidizing conditions in critical areas. It was concluded that the primary factor in all considerations of the special requirements for refuse incineration plants, compared to conventional steam boilers, is the conversion of wastes into sterile end products.

5057 APTIC NUMBER 14407

Edwards, Franklin J.
CATALYTIC VS THERMAL AIR-POLLUTION CONTROL. Contamination Control: Current and Advanced Concepts in Instrumentation and Automation, 8(9):10-13, Sept. 1969.

Oxidation (combustion) is probably the only method of pollution control which converts pollutants into innocuous end products with no need for a secondary process to dispose of such products. The two methods of combustion used in pollution control systems are catalytic oxidation and thermal incineration; a comparison is presented of the two types of systems. Both use similar flow diagrams: air moving device, preheat system, and oxidation chamber; both also use, in different ways, three heat transfer methods: conduction, convection, and radiation. In certain applications, only thermal incineration can be used; however, where there is a choice, several advantages are cited for catalytic oxidation. Because the catalyst system operates at lower temperatures (500-900 F) than a thermal system (1100-1550 F), a significant fuel saving, and hence cost reduction, can be realized. Catalyst systems are usually smaller and lighter, and because of lower operating temperatures do not require construction materials to be as heat-resistant, thus reducing construction and installation costs. The catalytic equipment can be made smaller and lighter because it has a faster reaction time and will purify exhaust streams passing through at a higher velocity. New catalyst systems today operate solely on the principles of catalysis; the most effective is one that incorporates principles of both catalysis and thermal incineration. Theoretical and technical aspects of catalytic systems are discussed, as well as factors to consider in choosing an oxidation system for specific pollution situations. Included among the appropriate pollution control applications for catalytic systems are solvent emissions (printing operations, paint drying, metal coating), many chemical process industries, certain food processing operations, and fume and odor control on diesel engines.

5058 APTIC NUMBER 13895

Edwards, Geoff
ENGINES OF THE IC ENGINE. Engineering (London), 207(5380):825-826, June 6, 1969.

The power units of 26 unconventional prototype vehicles developed by General Motors include turbines, electric and hybrid gasoline-electric systems. Due to problems of weight, cost, and mileage, none of these provides a promising alternative to the internal combustion engine. Preliminary tests show that the Se-101 steam engine, which uses conventional gasoline or diesel fuel in a continuous spray, releases low concentrations of hydrocarbons, carbon monoxide, and nitrogen oxides. Unfortunately, it is 450 lbs heavier than a comparable internal combustion engine. Lead-acid or silver-zinc batteries have not substantially increased the range of electric cars or reduced their weight. A hybrid gasoline-electric car can operate either as a hybrid or as an all-electric car. When powered by the gasoline engine, a fraction of the output from the engine can be used to drive a generator and recharge the batteries powering the electric system. Top speed is 35 mph in the hybrid mode and 30 mph in the electric mode. The car's range is about 150 miles. It is concluded that the internal combustion engine can be modified to meet requirements on exhaust emissions.

5059 APTIC NUMBER 14651

Vidner, Dieter
DEVICE FOR REMOVAL OF GAS COMPONENTS FROM GASES BY ABSORPTION, PREFERABLY DESIGNED AS MULTI-STATE SCRUBBER, AT HIGH FLOW VELOCITYPS. (Vorrichtung zur absorptiven Entfernung von Gaskomponenten aus Gasen, vorzugsweise als Stufenwascher, bei hohen Stroemungsgeschwindigkeiten). Text in German. (Dieter Vidner, Freiberg) W. German Pat. 58,289. 4p., Oct. 20, 1967. (Appl. Nov. 21, 1966, 7 claims).

An absorption tower or pipe containing conically-shaped veins and spray nozzles for the scrubbing liquid is described. The scrubbing liquid is conducted countercurrent to the gas flow so that a good contact between gas and liquid is established. The liquid or dust particles are precipitated on the wall. The tower is subdivided into chambers according to the number of veins. The scrubbing liquid is drawn off in each chamber and passed to the preceding stage. An annular slot in the inlet, together with the curved veins, deflect the gas flow and impart the necessary centrifugal force to the gas and increase its speed. Through contact with the atomized scrubbing liquid, the desired gas component is absorbed. The droplets carried along by the gas flow are thrown to the wall by the centrifugal force and precipitated. Each scrubber stage has a diffusor at the end. Within each scrubbing stage, fluid and gas travel in parallel flow. The cleaned gas flow leaves through slots in the inner wall.

5060 APTIC NUMBER 14642

IMPROVEMENTS RELATING TO THE RECOVERY OF SULPHUR DIOXIDE. (Electrolytic Refining and Smelting Co. of Australia, Pty. Ltd., Port Kembla) Australian Pat. 168,272. 5p., July 22, 1955. (Appl. Jan. 27, 1953, 9 claims).

A method is described for recovering sulfur dioxide contained in low concentrations from metallurgical and industrial flue gases. The apparatus used in carrying out the method includes a vertical, cyclindrical reaction tower containing a porous bed of reactive material, preferably metallic copper and/or a copper alloy or copper ore, in the form of wire, thin strips, or shavings. A solution of water and ammonia is supplied to the tower at a controlled rate; its strength is progressively increased by recirculating it through the porous bed. When gas is circulated upward through the bed, sulfur dioxide and the reactive material are dissolved in the liquid. Sulfur is recovered in the form of metallic salts or sulfuric acid.

5061 APTIC NUMBER 14836

Engels, Lothar-Hans
DEVELOPMENTAL TRENDS FOR DUST REMOVAL FROM HOT GASES. (Entwicklungstendenzen der Heissgasentstaubung). Text in German. Glueckauf (Essen), 105(8):353-359, April 17, 1969.

The state of the art of dust removal equipment for hot waste gases is reviewed. Cooling systems are of great importance, since they generally have to cool gases from 1000 C to 300 C. At present, there is a trend toward using envelope-type coolers with simultaneous separation of the coarse dust particles by deflection and impact. Such coolers can be economically operated at gas throughputs of up to 100,000 cu m/hr. Cloth filters are increasingly used, especially since temperature-resistant filter fabrics have been developed. The materials are mainly synthetic felts with a silicone, graphite, or teflon finish. Their main disadvantage is the high manufacturing cost. Double and multi-cyclones are frequently used as mechanical dust collectors. These usually consist of collectors for coarser particles followed by horizontally or obliquely arranged cyclone cells made of cast iron. Investment and operating costs for them are low and they can be operated up to temperatures of around 400 C. For short-term discontinuous development of hot gases found in the charging of coke furnaces, wet collectors can be used. Investment costs for these are also low. A cost comparison among the various dust collection methods is given based on a plant capacity of 100,000 cu m/hr.

5062 APTIC NUMBER 14406

SCRUBBER SYSTEM AIDS BYPRODUCT RECOVERY. Environ. Sci. Technol., 3(9):806-807, Sept. 1969.

A new scrubbing process which aims at the economical recovery of SO2 as ammonium sulfate is described. What distinguishes the scrubber is its effectiveness in removing SO2 and fly ash. The hot flue gases must be cooled as soon as they enter the scrubber. The cooled gases rise to a zone of very rapid acceleration and deceleration. Physically, this separation zone is the result of modular construction. The separator element stack is made up of polypropylene rings which are chamfered on all sides and held apart by spacers. The result is a very small venturi-like opening through which the gas flows radially outward without change of direction. During this process, the gas is very rapidly accelerated from near zero velocity. The subsequent equally rapid deceleration is responsible for fallout and agglomeration of the fly ash particles. A stream of rinse liquid carried in with the gas picks up the agglomerated solids and carries them back down to the cooling tower, leaving the clean gases to continue on toward the stack. It is technically feasible to convert the SO2 recovered in the separator to ammonium sulfate. It is pointed out that the chemistry of these processes is very simple and the equipment needed to carry out the reactions is uncomplicated and easily available commercially. Figures show that it would be better for utilities to go into the fertilizaer business than to switch to fossil fuels that are low in sulfur and in short supply.

5063 APTIC NUMBER 14873

Ertl, D.
DEVELOPMENT OF DUST REMOVAL TECHNIQUES FOR WASTE GASES FROM STEAM GENERATORS. (Entwicklung der Entstaubungstechnik fuer Abgase aus Dampferzeugungsanlagen). Text in German. Tech. Mitt., 62(8):338-342, Aug. 1969. 10 refs.

For cleaning the waste gases from steam generators, dry electrostatic precipitators are almost exclusively used. Therefore, the operating principles and recent improvements of this type of dust collector are discussed. The newest type of collecting electrode is the CSA electrode with lengths up to 12 m. The plate-type electrodes have a thickness of 1.1" to 1.25 mm and a width of 763 mm. The isodyne electrode W 17 was developed as an ionizing electrode for operation with the CSA collection electrodes. For dusts with extremely high resistance,

the band-shaped electrode # 5 is used. The fastening of these electrodes between the collection electrodes is particularly problematic. In the U. S., wires are pulled over the entire length of the field and fastened by weights, while in West Germany, frames are used for fastening the wires. With the latter method, spark erosion is avoided, but frames are very expensive. To obtain a uniform gas distribution, two to three perforated plates are installed in the inlet. Louvres are used for smaller inlets. To avoid by-pass flows, screens must be installed. In the past ten years, the field heights have increased from 6 to 12 m. Fears that the higher field length would have an adverse effect on collection efficiency lead to detailed studies of the relationship, but no negative influence could be found. Thin layers of dust on the electrodes with an electric impedence of 10 to the eleventh power ohm-cm reduced voltage and current considerably. A high operating voltage must be used in this case.

5064 APTIC NUMBER 13002

Evans, R. Keith, Sheldon D. Strauss, and Rene J. Bender
POLLUTION'S CHALLENGE. Power, 112(6):S38-S45, June 1968.

The majority of toxic pollutants can be traced to automobile, train, truck and aircraft exhausts. They include unburned hydrocarbons, carbon monoxide, acrylic compounds, and nitrogen oxides. Industrial pollutants include organic and inorganic dusts and gases. One method of controlling atmospheric pollution is by desulfurization of fuel oils and coals before they are burned. Electrostatic precipitators, mechanical separators, dry or wet scrubbers, and bag filters are used for removing particulates from flue gases. Three basic processes -adsorption, absorption, and catalytic oxidation- are employed for desulfurizing flue gases. Automotive vehicles are responsible for 60 percent of the air pollution in U. S. cities. The most promising development in decreasing automotive pollution is the electric car which could remove a large proportion of the pollutants discharged into the air. In the case of uranium, the problem of protecting the environment stems from two characteristics: its radioactivity and its creation of radioactive compounds when it is fissioned in the course of generating power. Since the normal activity of uranium is low, normal ventilation and dust-collection practices allow the radioactivity to be harmlessly dispersed into the atmosphere. To control the fission products, multiple barriers are interposed between fissioning fuel and the atmosphere.

5065 APTIC NUMBER 14531

Pyzat, P. and J. C. Guibet
SIMULATION OF THE FORMATION OF NITRIC OXIDE DURING COMBUSTION IN AN ENGINE. (Simulation de la formation d'oxyde nitrique au cours de la combustion dans un moteur). Text in French. Rev. Inst. Franc. Petrole Ann. Combust. Liquides (Paris), 22(10):1530-1548, 1967. 3 refs.

Simulation of nitric oxide emission in engine exhaust gases by calculation from the pressure-time diagram was used in a computer program to determine the best combustion process with respect to nitric oxide formation and engine efficiency. The calculation of the pressure time diagram was first reviewed. Optimum operation was shown to correspond to rapid and relatively late combustion. The theoretical calculations of optimum combustion could be at least partially reproduced in actual running conditions.

5066 APTIC NUMBER 15357

PROCEDURE FOR DESULFURIZATION OF GASES. (Procede pour desulfurer les gaz). Text in French. (Farbenindustrie (I. G.) A.-G., Germany) French Pat. 846,165. 8p., Sept. 11, 1939. (Appl. Nov. 17, 1938, 4 claims).

The invention concerns a procedure for elimination of hydrogen sulfide and/or sulfur dioxide present in gases by bringing these gases into contact with wet lignite or with wet solid substances produced from lignite. The sulfur-containing substances are gasified or distilled at a low temperature jointly with another fuel. These gases are treated with aqueous suspensions of powders prepared from lignite or obtained from it in the course of its treatment. The gases may be submitted to further purification provided their H2S content is relatively low.

5067 APTIC NUMBER 14672

Feld, Walther
METHOD FOR SCRUBBING HYDROGEN SULFIDE AND SULFUROUS ACID FROM GASES AND VAPORS. (Verfahren zum Auswaschen von Schwefelwasserstoff und schwefliger Saeure aus Gasen und Daempfen). Text in German. (Assignee not given.) German Pat. 237,607. 5p., Aug. 23, 1911. (Appl. April 18, 1909, 4 claims).

A method for scrubbing hydrogen sulfide and sulfurous acid from gases and vapors was devised. Both types of gases either react simultaneously or successively with metal sulfates, thiosulfates, polythionates, etc. Metals are used whose sulfides are insoluble but which are decomposed in the presence of sulfurous acid alone or together with sulfur, oxygen, alkaline, neutral, or acid compounds of oxides, hydrates, carbonates, sulfides, sulfites, and thionates. Prior to, during, or after reaction of the hydrogen sulfide and sulfurous acid with the metal compounds, the products are treated with ammonia or ammonia-containing gases or vapors to decompose the metal sulfates formed. Gases or vapors which contain ammonia in addition to hydrogen sulfide and sulfurous acid are followed up with oxidizing agents to oxidize part or all of the sulfur compounds to sulfuric acid, thus obtaining ammonium sulfate. Either the gases and vapors, or the metal compounds, or both, are heated for the process. The equipment consists of a scrubbing tower, an absorption apparatus, a series of chambers, containers for the liquids, a filter press, an air pump, a pump for the liquids and a furnace for the combustion of sulfur.

5068 APTIC NUMBER 14365

Fernandes, J. H.
INCINERATOR AIR POLLUTION CONTROL. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 101-116. 48 refs. (May 5-8).

Although an incinerator stack may appear reasonably clean, the fly ash in the gas may be excessive. Large quantities of air used in incineration often mask the real pollution potential. As a result, stack observations are no measure of emission from an incinerator. An accurate determination of stack emissions can be obtained only by actual test based on samples taken in the duct leaving the air pollution control equipment. This paper presents a survey of the performance capability of air pollution control equipment. It is clear that more knowledge of incinerator pollutants is required, and some research must be performed if all classes of high-performance air pollution control equipment are to be applied to incinerators with optimum results. Regardless of whether lax or stringent air pollution regulations are in effect, collectors of good design, properly installed, operated, and maintained, can be selected. The relative cost of the various classes of equipment is presented. (Author summary modified)

5069 APTIC NUMBER 15389

Fields, Walter W.
FLUID TREATING APPARATUS FOR AN ELECTROSTATIC PRECIPITATOR. (American Air Filter Co., Inc., Louisville, Ky.) U. S. Pat. 3,468,105. 3p., Sept. 2, 1969. 13 refs. (Appl. Aug. 28, 1967, 2 claims).

The invention relates to an electrostatic precipitator whose improved fluid treating arrangement requires a minimum of parts to provide both oscillatory and axial movements of the fluid header assembly for effective treatment of collector plates. The precipitator includes a housing with opposed gas inlet and gas outlet openings defining a passage for the flow of gas and a collection section in the form of collection plates placed parallel to the direction of gas flow. An elongated fluid header assembly with a longitudinal axis has numerous fluid distributing orifices to direct fluid to the collector plates. A crank and cam assembly cooperate directly with the header assembly to permit oscillatory and axial movement of the header.

5070 APTIC NUMBER 14178

Finney, J. A., Jr.
SELECTING PRECIPITATORS. Power Eng., 72(12):26-30, Dec. 1968.

Characteristics of gas and dust are basic variables to be dealt with in the selection of an electrostatic precipitator. Gas characteristics include the constituents and their quantity, mass flow, temperature, and density, and how they vary with time. Dust characteristics include physical and chemical analyses, electrical resistivity, and moisture content. Uniform gas flow is a necessity for proper functioning of the precipitator. The flow is said to be uniform when, at a point 5 ft ahead of the precipitator inlet, at least 85% of the velocity readings are within plus or minus 20% of the average, and no reading deviates more than 40% from the average. Temperature of the precipitator must remain above the dew point or condensation occurs. The result is hopper-plugging, electrical leakage, corrosion, or rapping ineffectiveness. Precipitator design must take into consideration the effect of the space charge of dust particles, and, the more numerous the particles, the greater the effect. Dust resistance results in a voltage drop in the precipitator and must be accounted for in design.

5071 APTIC NUMBER 13398

Pones, R. P. and J. P. Sapp
OXIDATION OF KRAFT BLACK LIQUOR WITH PURE OXYGEN. TAPPI, 43(4): 369-373, April 1960. 6 refs.

Oxidizing black liquor from a kraft cooking process reduces kraft-mill odor, reduces corrosion in the evaporators, and minimizes the loss of sulfur compounds in the recovery process. Oxidation of kraft black liquor in a pressure vessel with pure oxygen as a possible means of circumventing some of the foaming problems attending the oxidation of black liquor is investigated. Experimental investigations tested the feasibility of oxidizing black liquor with pure oxygen either after separation from the pulp or just prior to blowing at the end of a normal kraft cook. All cooks were carried out in a laboratory experimental digester. Oxidation of the pulp alone resulted in the pulp darkening and the lignin content increasing. Oxidation of the black liquor alone would require the reducing the sodium sulfide content to prevent the formation of sodium thiosulfate. Costs of reducing the sodium sulfide content and the cost of the oxygen ($1100 per day) were too expensive for current applications. Although oxidation of pulp and black liquor at the end of a normal kraft cook results in complete oxidation, oxygen consumption rates are high and pulp strength and color are adversely affected.

5072 APTIC NUMBER 13404

Franz, R.
USE OF NATURAL GAS IN POWER AND HEATING PLANTS OF THE MUNICH CITY WORKS. (Einsatz von Erdgas bei Kraft-und Heizwerken der Stadtwerke Muenchen.) Text in German. Brennstoff-Waerme-Kraft, 20(1):5-8, Jan. 1968. 1 ref.

Natural gas mined in Bavaria has the composition: 0.2 percent CO2, 95.8 percent CH4, 2.8 percent C2H6, 0.5 percent N2, and 0.7 percent N2. Its heat of combustion is 9600 kcal/normal cu m, its heating value is 8700 to 8900 kcal/normal cu m, its density, referred to air is 0.569, and its specific weight is 0.736 kg/normal cu m. As it contains no S, it has come into wide use as fuel in the various thermal plants serving Munich. Newly erected plants are designed for this fuel only, while existing plants have been and will be modified for its use. Engineering experiences during the plant modifications are the principle topic of this paper.

5073 APTIC NUMBER 14503

Freitas, Ernest R., Clarance L. Dunn, and Keith E. Zarker
METHOD OF SEPARATING ACIDIC GASES FROM GASEOUS MIXTURE.
(Shell Oil Co., New York) U. S. Pat. 3,463,603. 5p., Aug. 26, 1969. 3 refs. (Appl. March 17, 1967, 12 claims).

A process for separating acidic gases from gaseous mixtures involves contacting a gaseous mixture with a liquid absorbent comprising 35-65% by weight monoisopropanolamine (MIPA), 5-45% by weight of a cyclotetramethylene sulfone, and 20-40% by weight water. The process makes it possible to obtain a high degree of removal, at very low solvent flows and heat loads, of CO2 from gas mixtures in which the partial pressure of CO2 varies from 0.01 to 1000 psi and of CO2 and other acid gases, such as H2S, at partial pressures less than 150 psi. Since cyclotetramethylene sulfone has a reduced capacity for absorption of gases at partial pressures below 150 psi, the process is primarily chemical in nature. It may be used in treating flue gas, synthesis gas, refinery, or natural gas mixtures.

5074 APTIC NUMBER 14223

French Electrical Industry (France), Oise Thermal Production Regional Group
ADAPTATION OF COMPRESSED-AIR SWEEPING INSTALLATIONS ON DUST-REMOVING DEVICES. (Adaptation d ' installations de ramonage a l' air comprime sur des depoussiereurs.) Translated from French. (12)p., (1968).

Experiments have been conducted at the Porcheville power station on compressed-air sweeping devices for dust removers. The test installation includes 14 sweepers. Each sweeper is made up of a blowing line and an outdoor sweeping head. Utilization, operating conditions and costs are discussed. The results obtained are very satisfactory: the precipitation panels remained clean after 2 years of operation.

5075 APTIC NUMBER 14519

Frysinger, Glen R.
HYDROGEN REFORMING FOR FUEL CELLS. Franklin Inst. Research Labs. Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. Fir t Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 459-476.

Fuel cells are basically reactors of hydrogen and oxygen. They are being considered for use in hydrocarbon-air fuel cell engines which may have better pollution characteristics than conventional engines. Since oxygen is readily available, the problem is one of converting liquid hydrocarbons into hydrogen fuel with lightweight equipment. Direct anodic oxidation is not practical because of the amount of platinum catalyst required. Another approach to hydrocarbon reforming is based on the internal reforming cell in which the catalyst is located next to a silver-palladium anode in the fuel cell. This anode transmits the hydrogen formed in the reformer cavity directly to the fuel cell where it is oxidized electrochemically on an electrolyte. Hydrogen formation depends on current density of the fuel cell, which is reduced by catalyst degradation. However, desulfurization cartridges should protect reformers against excessive catalyst degradation. High reliability in fuel cell systems is achieved by feeding fuel and water through digital injection systems rather than through stroke piston pumps. Fuel cell reactions using hydrogen and oxygen are clean, since water is the only offgas product. Even using a hydrocarbon fuel, these cells will enable 1980 emission standards to be met.

5076 APTIC NUMBER 14951

Fujii, Shoichi
A RESEARCH REPORT ON THE IMPROVEMENT OF AIR CIRCULATION INSIDE A RAILROAD CARRIAGE. (Syanai kanki kaized no kenkyu ni tsuite). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(1):8-31, April 1969. 10 refs.

The purpose of this research was to examine the air pollution inside a highly modernized railroad carriage using the new Tokaido Line as an example. It was also aimed at finding a device to solve the problem. In the first test, the dust was measured using a dust meter, an air filter, a hygro-thermometer, and deodorant musk inside the controlled atmosphere carriage. In the second test, the air circulation in the carriage under operating conditions was studied. This carriage was equipped with a dust meter, an ionizer, an ion density meter, and an air filter unit with active carbon. The third test studied the influence of cigarette smoking in a carriage. Results show that the 35 cu m/min of fresh air provided by air circulation was sufficient in terms of CO2 supply. Pollution increased while the train went through a tunnel. An ordinary ionizer could not cover a wide enough area in the carriage. Odor in the train was mainly caused by cigarette smoke, and a high-fidelity air filter was recommended to diminish the odor and dust density. Two problems left to further study are pressure in the high-fidelity air filter and economic feasibility of operation.

5077 APTIC NUMBER 15622

Fujii, Toru
A CONTROL METHOD OF THE EMISSION GASES FROM VINYL CHLORIDE MANUFACTORY. (Enka biniru kojo no haigasu to sono taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(5):267-270, May 15, 1968. 9 refs.

Complaints in Osaka City from 1961 through 1966 included 27 cases concerning human effects and 4 cases concerning plant effects, possibly caused by exhaust gas from vinyl chloride factories. Under certain conditions, the exhaust gas seriously harms plants, and its effects extend over a wide region. Harmful components of

the exhaust gas exist as mists, where the exhaust gas is emitted in the air without any treatment. In some plants, the exhaust gas is washed by a water shower; however, it is inefficient. Two venturi scrubbers were installed after the cooling tower for the flue gas as a countermeasure in one plant. The rate of phthalic acid removal was 99%; ammonium, above 90%; diisobutyl phthalate, 99.4%; dibutyl phthalate, 99.4%; and dioctyl phthalate, 99.6%. It is concluded that a large amount of exhaust gas in the foaming process is the source of air pollution, and the venturi scrubber is extremely effective in removing the harmful component.

5078 APTIC NUMBER 14944

Fukuchi, Tomoyuki and Takeo Yamamoto
A FEW IDEA ON COUNTERMEASURE AS TO BE CONNECTION WITH EXHAUST GAS FROM GAS-WORKS AND DAMAGE ON MANDARIN. (Toshigasu seizokojyo no haigasu to mikan no higai narabini sono taisaku ni kansuru shokosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):17-23, Sept. 1969. 22 refs.

Because mandarin oranges fell from trees before the harvest period, waste gas from a gas works near the orange orchard was suspected to be the cause. With this idea as a starting point, the relationship between waste gas and ripening oranges was examined in a laboratory. The possibility that the ripening period had been accelerated by other factors, such as hydrocarbon gases, especially ethylene, was considered. It was reported by Magill that the tomato is influenced by hydrocarbons such as ethylene, 0.1 ppm; acetylene, 50 ppm; propylene, 50 ppm; and butylene, 50,000 ppm. Thus, a very small amount of ethylene has a great influence on ripening fruit. According to the result analysis of the waste gas, the assumption that windblown ethylene influenced the ripening orange is reasonable. The boiler system for waste gas control is shown. By means of chemical reactions, ethylene vanished at 260 C. Gas compounds are first prevented from entering the boiler and are then sent to a reservoir tank and mixed with catalyst and steam, and finally discharged in vapor form. By this treatment, the waste gas compounds are vaporized. Since this boiler system has been used at the gas works, damage to oranges has decreased.

5079 APTIC NUMBER 14355

Fukui, Syoze
HYGIENIC CHEMICAL STUDIES ON PUBLIC NUISANCE BY INJURIOUS GASES. XI. FUNDAMENTAL STUDIES ON REMOVAL OF NITROGEN OXIDES FROM GASES BY THE TREATMENT WITH AMMONIA (NO. 2). ON THE MECHANISM OF REACTION BETWEEN NITROGEN OXIDES AND AMMONIA. (Yudoku gasu ni yoru kogai no eisei kagakuteki XI. Amnoniya shoriho ni yoru Chisso sankabutsu no jokyoho (sono 2). Chisso sankabutsu to ammoniya no hanno kiko). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 13(1):22-28, 1967. 8 refs.

Treatment of waste gases with ammonia has previously been found effective in removing nitrogen oxides. The present investigation concerns the mechanism of the reaction between nitrogen oxides and ammonia in the gas phase. The reaction proceeds according to the equation 2NO2 plus 2NH3 yields NH4NO3 plus N2 plus H2O. If the ammonium nitrate produced by the reaction is removed by some mechanical means, the only gase emitted will be nitrogen. Since nitric oxide did not react with ammonia, it was oxidized to nitrogen dioxide or nitrous anhydride by air and treated with ammonia. The reaction between nitrous anhydride and ammonia is N2O3 plus 2NH3 yields NH4NO2 plus N2 plus H2O. (Author abstract modified)

5080 APTIC NUMBER 13781

Ganz, S. N., P. I. Braginskaya, N. I. Gogodetskiy, and M. A. Lokshin
ABSORPTION OF NITROGEN OXIDES WITH MILK OF LIME IN MECHANICAL ABSORBERS OF PILOT INSTALLATIONS. (Absorbtsiya okislov azota izvestkovym molokom v mekhanicheskikh absorberakh opytno-promyshlennoy ustanovki). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii Khim. i Khim. Tekhnol., 5(1):155-159, 1962. 8 refs.

Pilot operation of a 16 cu m-capacity absorber for absorbing nitrogen oxide with milk of lime was carried out for six months. Physicochemical and hydrodynamic factors were studied to establish the dependence of degree and rate of absorption of nitrogen oxides by Ca(OH)2 solution on concentration of nitrogen oxides in the gas, and the dependence of the concentration of nitrite-nitrate salts and CaO in the solution on volumetric gas flow rate and quantity of liquid in the apparatus. Experiments were made at 45-50 C and 55-60 C. Estimates indicate this method will give a ten-fold reduction in the cost of HNO3 production, with an annual amortization cost of 10,500 rubles as compared with 165,600 rubles for existing methods.

5081 APTIC NUMBER 13803

Ganz, S. N., Y. Y. Kuznetsov, V. A. Shlifer, and L. Y. Levkin
REMOVAL OF NITROGEN OXIDES, SULFUR DIOXIDE, AND SULFURIC ACID MIST AND SPRAY FROM INDUSTRIAL EXHAUST GASES USING ALKALINE PEAT SORBENTS. (Ochistka vykhlopnykh gazov ot okislov azota, sernistogo gaza, tumana i bryzg sernoy kisloty torfoshchelochnymi sorbetami v zavodskikh uslovivakh.) Text in Russian. Zh. Prikl. Khim., 41(4):720-725, 1968. 1 ref.

Studies on the purification of exhaust gases from the Mills-Packard process under industrial conditions revealed that the most effective additive to the peat sorbents was ammonia, the sorption of gases producing a useful organomineral fertilizer. Addition of the ammonia directly to the boiling layer of sorbent was the most efficient method, and three sorbent layers were used. Successive layer thicknesses were 200-300, 300-400, and 400-450 mm with moisture content 35-40, 40-45, and 45-55 percent, respectively. Raw material requirements for sanitary purification of 60,000 cu m/hr are (in tons per hr): 0.298 ammonia, 1.5 dry peat, and 3 peat with 50 percent moisture. The ton-per-hour trapping rate was: 0.318 nitrogen oxides, 0.405 sulfur dioxide, and 0.012 sulfuric acid. Data are given for the effectiveness of the resultant fertilizer determined from agricultural study.

5082 APTIC NUMBER 14628

Gazaryan, I. M.
CERTAIN QUESTIONS OF GAS PURIFICATION IN NONFERROUS METALLURGY. (Nekotoryye voprosy gazoochistki v tsvetnoy metallurgii). Text in Russian. Tsvetn. Metal., no. 8:69-75, 1960. 1 ref.

Electrical purification of gases is discussed in general terms with the collection of cadmium and arsenic receiving specific mention. Major discussion is given to the utilization of SO2 from exhaust gases of the nonferrous metals industry with attention directed toward reduction of SO2 to elemental sulfur. Data on the discharge of SO2 at five different copper smelting plants (Karabashsk, Kirovgrad, Krasnoural'sk, Middle Ural, and Balkhash) are given. The economic and health implications of conversion to elemental sulfur purification are discussed with specific reference to the Karabashsk plant. The arrangement of the Kirovgrad plant, based on the reduction of dilute sulfur dioxide by generator gas, is strongly criticized. Suggestions for converting to direct reduction to elemental sulfur over glowing coke are put forth and are based on reported efforts outside of the Soviet Union.

5083 APTIC NUMBER 14771

Gehman, Roland P. and Eugene G. Martin
FOAM GENERATING MECHANISM FOR DUST CONTROL. (MSA Research Corp., Evans City, Pa.) U. S. Pat. 3,453,678. 6p., July 8, 1969. 6 refs. (Appl. July 13, 1967, 9 claims).

A mobile power-operated machine which generates foam and discharges it on a dusty surface such as a roadway prior to cleaning is described. No dust rises into the atmosphere when the foam-covered dust is swept into a powered sweeping machine. The machine comprises a wheel-supported frame with the foam distributor adjacent to the forward part of the frame, which is connected to the foam generator. The generator discharges the foam in a layer of predetermined width and thickness. A rotating brush at the rear of the frame sweeps the foam-penetrated dust into an accumulated mass.

5084 APTIC NUMBER 14650

Gensecke, Wilhelm, Hans Weidmann, and Wolfhart Siecke
PROCESS FOR THE REMOVAL OF SULFUR DIOXIDE FROM GASES CONTAINING SUCH SUBSTANCES. (Verfahren zur Entfernung von Schwefeldioxyd aus solches enthaltenden Gasen). Text in German. (Metallgesellschaft A. G., Frankfurt am Main, West Germany) German Pat. 593,383. 3p., Feb. 28, 1934. (Appl. Oct. 2, 1931, 2 claims).

A process is described for the removal of sulfur dioxide from gases using an aqueous suspension of combustion residues such as fly ash which contain unburned coal. The metals contained in the fly ash in the form of aluminates, silicates, etc., are rapidly dissolved, yielding various types of sulfates. The reaction process is speeded by the presence of oxygen in iron and manganese oxides which are also contained in the combustion residues. To demonstrate the efficiency of the process, various examples are given. A roasting gas with 0.5% SO2 and 5.5% O2 was scrubbed at 50 C with an aqueous suspension of coke ash containing 9.88% C, 39.10% SiO2, 27.73% Al2O3, 11.12% Fe2O3, 3.13% CaO, and 1.39% MgO. For binding 1 kg of sulfur as SO2, 4 kg coke ash were needed. Using a fly ash with 14.90% C, 58.8% SiO2, 11.48% CaO, 1.35% Al2O3, 5.48% Fe2O3, 0.17% Mn3O4, 0.12% TiO2, 3.06% MgO, 0.72% SO3, 0.18% sulfide, 1.76% CO2, and traces of P2O5, 2.5 kg coke ash were needed to bind 1 kg sulfur.

5085 APTIC NUMBER 14725

Gerth, Gerhard
DUST TECHNOLOGY. (Staubtechnik). Text in German. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 110(15):645-648, May 1968. 32 refs.

A literature survey of articles in the field of dust collection appearing between 1966 and 1967 is presented. An article on the new Roll-O-Matic air filter consisting of a central frame and a filter ribbon transportable automatically or manually is mentioned, along with articles discussing dust properties, grinding machines, the selection of filter material, the new British 'Stereoscan' electron microscope for studies of surface properties of dusts, the classification of dusts, the glass fiber tubular filter, and finally, a new air filter developed in Great Britain. The last filter can be used for concentrations as high as 700 million dust particles/cu m and can be cleaned with a vacuum cleaner and sudsy water. In addition, articles on continuous dust measurements, dust counting, and microscope sifting are briefly outlined. The Bahco microscope sifter is suitable for grain sizes as small as 3 to 4 microns. The Lurgi dust measuring unit has been modified so that it can now be used for hot and/or wet waste gases. A new unit which measures the dust concentration of the air by absorption of beta rays is on the market. It can be operated for months without service. In Russia, dust samples from an arc furnace are analyzed with the electron microscope UEMV-100 (200,000-fold enlargement). Articles on newly installed dust separation systems in Germany and other European countries are listed. Finally, the new U. S. standard 209a, an article about the effects of cement dust on humans, one on silicosis, and another on the new Japanese Clean Air Act are mentioned.

5086 APTIC NUMBER 14673

Gietl, Wolfgang Michael, Otto Grosskinsky, Georg Huck, and Harald Juentgen
METHOD FOR THE ADSORPTION OF SULFUR DIOXIDE FROM GASES CONTAINING SUCH SUBSTANCES. (Verfahren zur Adsorption von Schwefeldioxyd aus solches enthaltenden Gasen). Text in German. (Bergwerksverband zur Verwertung von Schutzrechten der Kohlentechnik G.m.b.H., Dortmund, Germany) W. German Pat. 1,046,818. 2p., Dec. 18, 1958. (Appl. April 26, 1958, 2 claims).

Soft or hard coal cokes were found to be excellently suited to adsorption of SO2 from gases. With low-temperature cokes from hard or soft coal containing at least 38% of volatile substances which have been oxidized at temperatures above 190 C, a several-fold volume of SO2 can be adsorbed per volume adsorbent. It is recommended that coals with a grain size between 1 and 3 mm be used. The temperature of the coking process has some influence on the adsorption capacity of the coke, and it should be between 600 and 800 C.

5087 APTIC NUMBER 15289

Girden, Barney R.
METHOD OF CONTROLLING SMOG. (Assignee not given.) U. S. Pat. 3,865,968. 8p., Sept. 9, 1969. 2 refs. (Appl. Nov. 9, 1968, 3 claims).

A method for controlling and substantially eliminating smog is directed toward effecting the ascension above coastal cities of thermal inversion belts which trap and retain pollutants near the surface of the earth. On-shore breezes which cause a thermal inversion belt to rise can be initiated and sustained by mixing cool, deep offshore water with warm surface water to reduce the temperature of the surface water to a value less than that of the adjacent earth surface. When the thermal inversion layer ascends, the cool, clean, and heavier oceanic atmosphere can then be substituted for the warmer, lighter, and polluted air by the phenomena of thermal convection. The invention proposes to achieve the turbulent intermingling of ocean water by installing pumping apparatus in selected submarine canyons bordering coastal areas. It has particular implications for Southern California, where a chain of submarine canyons and basins are located adjacent to the coastline. Best results will be obtained by initiating the on-shore breeze just before smog occurs, that is, in the early morning hours when the temperature of the earth's surface usually decreases to a point lower than that of the ocean.

5088 APTIC NUMBER 14891

Glenn, Richard A. and Robert D. Harris
LIBERATION OF PYRITE FROM STEAM COALS. J. Air Pollution Control Assoc., 12(8):388-395; 408, Aug. 1962. 2 refs.

The nature and mode of occurrence of pyrite in coal were studied in the laboratory as part of an effort to develop improved methods for reducing the amount of sulfur in coal prior to its being burned. Each of five high-sulfur bituminous coals were analyzed for forms of sulfur and size distribution of the pyrite particles. The major portion, by weight, of the pyrite in the samples was shown to exist as particles large enough to be readily separated once they are liberated. The experimental pulverization of coals by impact-shearing, by impact, and by air jet impingement were carried out. Results indicate that liberation of the major portion of the pyritic matter and nonpyritic mineral matter may be accomplished by controlled pulverization to sizes coarser than that now obtained in modern pulverized coal-fired power plants. It was shown that during pulverization the pyrite tends to concentrate in the various particle-size fractions. The microscopic pyrite particles embedded in the coal substance tended to concentrate in the very fine fractions, below minus 200 mesh; the larger pyrite particles, that are associated with the mineral matter, concentrated in the greater-than-60-mesh fraction. Where the pyritic sulfur is mainly associated with mineral matter, there are good prospects of its removal by presently-available equipment. Removal of the pyritic grains embedded in the organic matter requires the development of improved equipment for processing coal in the minus 200 mesh size. (Author summary modified)

5089 APTIC NUMBER 18753

Gol'dberg, M. S.
ON THE QUESTION OF PURIFYING INDUSTRIAL GASES. (K voprosu ob ochistke promyshlennykh gazov). Text in Russian. Gigiena i Sanit., no. 1:20-22, 1940.

Some historical aspects of the purification of industrial gases in the 1930s, first for the utilization of waste products and later for hygienic reasons, are discussed. Identification of problems, development of solutions, and resolutions to implement these solutions, particularly by establishing special factories to produce the requisite equipment, are discussed. Establishment of related educational programs is also mentioned.

5090 APTIC NUMBER 13870

Goodeve, C. F.
REMOVAL OF SULPHUR DIOXIDE FROM GASES. (Assignee not given) U. S. Pat. 2,021,588. 3p., Nov. 19, 1935. (Appl. May 28, 1932, 1 claim).

A process for the removal of sulfur compounds from flue gases with a minimum expenditure of reagents, catalysts, and water is discussed Sulfur dioxide is absorbed first by an acid solution of iron sulfate and then by an alkaline suspension of iron hydroxide. After the liquor has left the absorption apparatus, oxidation takes place. The acidic effluent contains dust and calcium sulfate in suspension, which are removed. After removal, a calculated quantity of chalk in suspension is added to the iron sulfate solution for mixing, and further oxidation takes place. Periodically, the precipitated catalyst and any calcium sulfate present are removed and returned to the system. Other catalysts such as manganese salts may be used, but iron salts are preferred.

5091 APTIC NUMBER 15360

Gosselin, Albert Eugene, Jr.
PROCEDURE FOR SEPARATION OF SULFUR DIOXIDE FROM A GAS STREAM. (Procede de separation du dioxyde de soufre d'un courant gazeux). Text in French. (Air Preheater Co. Inc., Wellsville, N. Y.) French Pat. 1,511,370. 3p., Jan. 26, 1968. (Appl. Feb. 18, 1967, 10 claims).

The invention concerns a procedure for separation of sulfur dioxide from a stream of hot gases in which one introduces into the gas stream an amount of calcined dolomite powder which is theoretically required to adsorb sensibly all of the SO2 transported by this stream. The powder is dispersed in this stream so as to insure its intimate contact with the SO2, and the gas stream containing the calcined dolomite is directed into a device for permeable filtering on which the calcined dolomite collects in such a manner that the intimacy of the ultimate contact between the calcined dolomite and the free SO2 in the gas stream increases. The temperature of the gas is limited by its passage through a heat exchanger located upstream of the filter and should not exceed 182 C at the time of introduction of the calcined dolomite powder. The permeable layer of calcined dolomite accumulated on the filter progressively increases the intimacy of contact between the calcined dolomite and the SO2 transported by the gas stream, this increase being proportional to the increase of the thickness of the bed of calcium dolomite on the surface of the filtering device. The contact between the calcined dolomite and the gas stream carrying the SO2 is periodically interrupted in order to remove the calcium dolomite from the surface of the filter. An appreciable fraction of SO2 is adsorbed by the calcined dolomite upstream from the filtering device. The efficacy of the filtering device for particle elimination increases with the amount of calcined dolomite collected on its surface.

5092 APTIC NUMBER 15257

Groezinger, H.
IMPROVEMENTS IN EXHAUST GAS COMPOSITION OF CARBURETOR ENGINES. (Abgasentgiftung bei Vergasermotoren). Text in German. Motortech. Z. (Stuttgart), 29(9):355-365, 1968. 18 refs.

Recently developed measures for reducing automotive emissions are reviewed. The carburetor, the ignition system, the shape of the combustion chamber, stroke vs bore ratio, design of the intake pipe, and the cooling system are responsible for the amount of emissions. The amount of CO and hydrocarbon emissions can be reduced (1) by oxidizing the CO and the unburnt hydrocarbons in the exhaust system through air injection (afterburning) and (2) by limiting the emissions from the cylinders. Optimum reduction of emissions through afterburning depends on an adequate air injection, a carefully adjusted fuel-to-air ratio, and on a proper timing of ignition. Measures involving the carburetor include a limiting device for maximum and minimum fuel-to-air ratio at idling engine, a device for thorough fuel mixing at idling and partially loaded engine, adjustment of the fuel/air ratio at idling engine to the different frictional forces of new and used engines, closer tolerance of the bypasses, exact adjustment of the temperature of the fuel/air mixture to the temperature of the engine, etc. Transport of the fuel/air mixture to the cylinders and uniform distribution are of great importance for emission control. Several illustrations of the distribution of the fuel/air mixture by various types of carburetors are given. Improvements through modification of the carburetor are indicated in graphs. In California, hydrcarbon emissions by automobiles have been limited to 275 ppm, CO emission to 1.5%. In 1969, the Federal Republic of Germany will limit CO concentrations at idling engine to 4.5%.

5093 APTIC NUMBER 15685

Guehne, Hanspeter
DONALDSON AIR CLEANERS FOR GAS TURBINES. (Donaldson-Luftfilter fuer Gasturbinen). Text in German. Motortech. Z. (Stuttgart), 330(10):373-379, Oct. 1969. 5 refs.

The compressor and turbine blades of gas turbines are eroded by drawn-in dust. Depositions of dust are primarily found in the heat exchanger but also in the compressor and the turbine. Corrosion is less damaging to vehicle gas turbines. Measurements have shown that the erosion is proportional to the weight of the drawn-in dust. The literature gives contradictory information on the influence of the grain size of the dust. It has been claimed that at constant dust concentration the life of the turbine is indirectly proportional to the grain size. Others claimed that particles of less than 10 microns have no erosive effect. Experience has shown, however, that air filters are required to protect the gas turbine. The Donaldson air filter system consists of a preliminary cyclone collector with a collection efficiency of 92 to 98%. Nearly all particles of more than 20 microns are removed. The cyclone also retains water and water mist. The main filter consists of natural or chemical fiber potted into artificial resin. The fiber material is folded in zig-zag form to obtain a large collection surface. The filter can be combined with a muffler. It can be used for stationary, automotive and helicopter gas turbines.

5098 APTIC NUMBER 13772

Guest, P. T.
DEVELOPMENTS IN BLACK LIQUOR OXIDATION. Pulp Paper Mag. Can., 66(12):T 617-T 622, Dec. 1965. 8 refs. (Presented at the Annual Meeting of the Pacific Coast Branch, Tech. Sect., Canadian Pulp and Paper Assoc., Harrison Hot Springs, B. C., May 9-11, 1963.)

The overall status of black liquor oxidation in the West Coast kraft pulp industry is reviewed. The most prevalent oxidation techniques are the Collins system, the B. C. Research Council system, and the Troebeck-Ahlen system. The Troebeck-Ahlen and the Collins type systems oxidize by forcing air through the liquor to make a controlled volume of foam. The B. C. Research Council unit operates with air blowing concurrently with the liquor over specially designed plates. Other systems use packed columns with either concurrent or countercurrent air, compressed air in a tank of liquor, or compressed air in a pipeline. The Crofton pilot plant has incorporated a more positive pattern of liquor flow to combat difficulties in maintaining pressure drops, an integral foam box with carryover space, a new type of combination cyclone with a foam breaker, and a simplified square design into its system. The several advantages to black liquor oxidation include a reduction of odor in the evaporator condensate and recovery stacks, reduction in sulfur losses, and less corrosion of the mild steel evaporator tubes and strong black liquor piping. Reduction in the recovery furnace odor emission can only be obtained when a furnace is not overloaded and therefore operated with sufficient air.

5095 APTIC NUMBER 13728

Guyot, G.
PRODUCTION OF CONCENTRATED SULPHURIC ACID FROM SULPHUROUS GASES WITH HIGH WATER VAPOUR CONTENT. (Fabrication d'acide sulfurique concentre a partir de gaz sulfureux a forte teneur en vapeur d'eau). Text in French. Chim. Ind. (Paris), 101(6):813-816, March 1969.

Although the contact process is applicable to both dry and wet gases, the sulfuric acid produced from wet gases by this method has a relatively low concentration (80%). A process is described for producing commercial concentrations (98%) of the acid from sulfurous gases with a high content of water vapor, even when the sulfur dioxide content is lower than 1%. The unit operating at Lacq is given as an example of the economics and applications of the process. (Author abstract modified)

5096 APTIC NUMBER 18632

Haagen-Smit, A. J.
REMOVAL OF PARTICULATE AND GASEOUS CONTAMINANTS FROM POWER PLANT FLUE GASES. Air Pollution Control Assoc. Los Angeles West Coast Section, Proc. Tech. Meet. Air Pollution Control Assoc., West Coast Sect., 1st, Los Angeles, 1957, p. 102-110.

Methods for the removal of power plant flue gases are discussed. Two pilot plants in operation at the El Segundo Steam Station are working on the reduction of sulfur trioxide. One is an APPA unit working on the hot side of the air preheater, and the other is a Western Precipitation unit operating on the cold side of the air preheater. Many schemes for the removal of sulfur dioxide and nitrogen oxides are also being tested with flue gases pumped from one stack through the laboratory and out to the other stack. Through the loop in the flue gas line goes 100 cu ft/min of flue gas of relatively constant composition and temperature. Processes such as washing with water to remove SO2 were considered but were not economically feasible for large plants. Other processes, such as scrubbing with ammonium sulfite are not applicable in their present state to stack gases containing low concentrations of SO2 found from the combustion of oil. A dry scrubbing method using adsorption charcoals has promise in that charcoal has a remarkable ability to remove sulfur from large volumes of flue gas and can be reused. Since considerable adsorption of SO2 from flue gas is possible at 150 F, cooling the gas is not necessary. The desorption can be accomplished with steam, aqueous ammonia, or heating. In this procedure, SO2 is recovered in concentrations of 50-75% and NO or NO2 is also adsorbed. The breakthrough point for nitrogen oxides occurs much earlier than for SO2. Since the adsorption boundary of SO2 is sharply defined, there is the interesting possibility of eluting the two components separately at different column heights. A continuous flow system could then be adopted for each of the sections. For the control of nitrogen oxides, the possibility exists of decomposing them. Another approach consists of reduction with carbon, CO, hydrogen, or methane. Application of this method to the power plant problem is difficult, because flue gas contains excess oxygen which rapidly consumes available reducing agents. Nitrogen oxides removed by oxidation with HNO3 does not work at low temperatures. A great deal of research is needed to make these proposed schemes economically feasible.

5097 APTIC NUMBER 18404

Hale, Edith A.
AUTOMOBILE POLLUTION FABRICATOR. (Assignee not given.) U. S. Pat. 3,456,439. 3p., July 22, 1969. 5 refs. (Appl. June 26, 1967, 3 claims).

The invention provides an improved means of eliminating the combustion residue (smog) from automobile exhaust. The fog is eliminated principally in a refrigeration unit connected to the muffler and the unburnt particles in the smoke are removed in a baffle unit which receives the output of the refrigeration device. Noxious gases which are mostly lighter than air, are then permitted to escape into the atmosphere. The system provides a clock device for automatic operation and a special power source for operating the system when the vehicle is not being used.

5098 APTIC NUMBER 18604

Hamblin, R. J. J. and W. J. Faust
CATALYTIC SYSTEMS FOR LEADED AND UNLEADED GASOLINE EXHAUSTS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p.131-159.

The problems of achieving complete catalytic combustion of oxidizable components other than unburned hydrocarbons, carbon monoxide, and nitrogen oxides are discussed. A catalyst placed in the exhaust system must be capable of dealing with lead, halogens, sulfur, and phosphorus in all combinations with oxygen and with each other. The catalyst must have a size and shape consistent with requirements for good flow distribution and low pressure drop. The catalyst bed itself and the individual particles must also not be subject to plugging by particulate matter. A catalytic converter lowers the concentrations of all pollutants in the exhaust gas stream and does not manufacture any new ones. The automobile manufacturers achieved significant reductions in carbon monoxide and hydrocarbon emission levels by controlling carburetion and ignition and by adding secondary air to the exhaust system. However, the still lower levels of emission desired after 1970 will be difficult to attain without further losses in vehicle performance. They may even be unattainable without catalytic converters. The use of present-generation catalysts may permit the recovery of the performance that already is sacrificed by engine modifications. The development of catalysts which can operate successfully for extended mileage on leaded fuels was accomplished. The performance of catalysts on unleaded fuels

is outstanding. With leaded or unleaded fuel, a catalytic converter coupled closely to the exhaust manifold, under any engine operating conditions, assures lower emission levels than any other system.

5099 APTIC NUMBER 15584

Hangebrauck, Robert P. and George D. Kittredge
THE ROLE OF COMBUSTION RESEARCH IN AIR POLLUTION CONTROL.
Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 17p., Sept. 1969. 10 refs. (Presented at the Combustion Institute, Eastern States Section, Technical Meeting, Morgantown, W. Va., 1969.)

Research and development projects aimed at developing technology for minimizing emissions from combustion processes are reviewed. The projects are discussed in relation to specific pollutants and sources, which include electric power production, industrial and residential combustion, refuse combustion, and motor vehicle sources. For stationary sources of pollution, fluid bed combustion may provide an economical system of heat generation for reducing emissions of sulfur oxides, and perhaps nitrogen oxides, from fossil-fuel combustion by steam-electric power stations. Research is in progress on models for predicting nitrogen fixation; these models would be used in design of burners and boilers for low output of NOx. Another possibility for controlling power generating systems involves integrating new power cycles with fuel cleaning. Improved burner and furnace designs offer opportunities for reducing pollution from sources other than power generators. Current development work in incineration could lead to both lower pollution levels and better use of resources by heat recovery. For motor vehicle sources of pollution, the possibilities of control are diverse. Industry is concentrating chiefly on enhancing combustion in spark-ignition engines by improving fuel atomization, air-fuel mixing, and distribution. Also under study are changes in fuel composition, high-temperature exhaust system reactors, and exhaust gas recirculation for NOx control. Elsewhere, alternative types of low-emission propulsion system, in particular Rankine cycle systems, are under development. Control techniques for diesel engines are directed toward improving fuels and engine designs to eliminate smoke and odor. Finally, projects for reducing emissions from aircraft are underway.

5100 APTIC NUMBER 14505

Haritatos, Nicholas J. and Phillip D. Harvey
SULFUR RECOVERY. (Chevron Research Co., San Francisco, Calif.) U. S. Pat. 3,463,611. 9p., Aug. 26, 1969. 8 refs. (Appl. May 1, 1967, 11 claims).

The invention presents an economical method of manufacturing sulfur from hydrogen sulfide and other sulfur compounds present in the oil fed to a hydroconversion process. It produces a sufficiently high ratio of hydrogen sulfide to inert gas (usually carbon dioxide) to recover sulfur by the Claus process. A purge stream is withdrawn from a hydroconversion zone recycle gas stream containing hydrocarbons, hydrogen, hydrogen sulfide, and other gases. The purge stream is then passed to a partial oxidation zone where hydrocarbons are partially oxidized to hydrogen, carbon monoxide, and carbon dioxide. Hydrogen sulfide and carbon dioxide are removed from the partial oxidation zone effluent and fed to the Claus process. Hydrogen and carbon monoxide present in the oxidation zone effluent are recycled to the hydroconversion zone. Separation of the hydrogen sulfide and carbon dioxide in the partial oxidation zone is accomplished economically by a physical absorption process at 500-2000 psig.

5101 APTIC NUMBER 15692

Haseba, S, Takeshi Tsunemoto, Kenjiro Takeshita, and Seiji Arita
DESULFURIZATION OF COALS IN COKING PROCESS. (Sekitan no Kokusuka Katei ni okeru Datsuryu). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 48(512):892-898, Dec. 20, 1969. 8 refs.

In carbonizing coal at high temperatures, 50 to 90% of the sulfur content remains intact. The remaining content of inorganic sulfur is 62 to 66% and that of organic sulfur, 45 to 75%. Inorganic sulfur can be eliminated to a considerable extent by coking coal, but the elimination of organic sulfur is extremely difficult. Several experiments were conducted using Miike and Matsushima mine coals. Since the most suitable temperature for desulfurizing coal is 400 to 600 C, an effective desulfurizing agent and catalyst in this temperature region was sought. The suitable temperature for the desulfurization using hydrogen gas was about 800 C, above which the bonding of sulfur with coal became a great problem. Active hydrogen was supposed to be more effective than the molecular hydrogen. Carbonization of coal in the presence of tetraline, isopropyl alcohol, or cyclohexane as a source of active hydrogen was examined. Tetraline was more effective than hydrogen gas in the temperature region from 500 to 600 C. After transforming organic sulfur to pyrite sulfur in the presence of the compound, sulfur was removed by thermal decomposition. Carbonization with some inorganic compounds other than iron compounds was examined. Strong bases such as potassium hydroxide and sodium hydroxide can remove the sulfur, but their unfavorable effects on the gain and quality of coal prevent their utilization. Calcium hydroxide increases the sulfur content of coal obtained by fixing the sulfur as sulfur compounds, which can not be removed by washing with water or acid.

5102 APTIC NUMBER 14967

Hein, G. M. and P. B. Engdahl
A STUDY OF EFFLUENTS FROM DOMESTIC GAS-FIRED INCINERATORS. (American Gas Association, Inc., New York, Proj. DG-3M, 27p., June 1959. 24 refs.

Measurements were made of the effluents from nine domestic gas-fired incinerators, including two new prototype models, five new commercial units, and two older units. Standard test charges that typified wet domestic wastes and dry combustible materials, and two special refuse mixtures were burned. A free-standing chimney provided natural draft for the units. Sampling and analytical techniques were based on recognized methods. The

concentrations in ppm in the flue gas and the emission rates in pounds per ton of refuse burned were determined for aldehydes, nitrogen oxides, organic acids, ammonia, and hydrocarbons. Grain loadings and emission rates were determined for particulate matter which included tarry organic materials. Odor and smoke density were also determined. Results demonstrated that significant reduction in emissions has been achieved through recent improvements in incinerator design. When wet domestic wastes are incinerated in new units, of up to 6-fold decreases in the rate of aldehyde emissions are achieved. Decrease in organic acids is 3-fold; decrease in saturated hydrocarbons is 8-fold. Although nitrogen oxides have increased 3-fold because of increased gas in the afterburner, their concentration is still lower compared to other combustion sources. Smoke, odor, and particulate matter emissions decreased to acceptable levels. Comparison of these emission rates with those from municipal incinerators shows that the new improved gas-fired domestic incinerators have lower particulate emissions, and, in general, equally low emissions of gaseous pollutants. Emissions from improved gas-fired units were in most cases lower than those from other incinerators and large gas- and oil-fired industrial heating units; they were much lower than those from automobile exhaust. The results of the study provide a basis for modification of the present restrictions in certain areas on the use of gas-fired domestic incinerators and for confirmation of their present acceptance in other areas.

5103 APTIC NUMBER 14660

Herzog, G.
DESULFURIZATION OF FLUE GASES - PROBLEMS AND SOLUTIONS. (Die Entschwefelung von Rauchgasen - Probleme und Losungswege). Text in German. Energietechnik, 17(12):539-542, Dec. 1967. 9 refs.

The state of the art of desulfurization methods in East Germany is reviewed. The main emission sources for SO2 in East Germany are the power production plants and the sulfuric acid industry. In 1965, the power plants emitted a total of 685,000 tons of SO2. The sulfuric acid plants emitted about 17,500 tons of SO2 in 1966. No economic desulfurization method yet exists to cope with these enormous emission quantities. The wet processes based on absorption of SO2 by aqueous or alkaline suspensions or solutions have three specific disadvantages. The gases must be cooled prior to the desulfurization process, which leads to corrosion problems in the heat exchanger; there is a waste water problem; and the cold, wet gases have no thermal buoyancy. Due to such problems, industry has turned to dry methods in recent years. The Weinluft process for oxidation of SO2 to sulfuric acid over an activated carbon catalyst has been of prime interest, although it is not economical. A brief outline of the essential principles of this method is given. Oxidation of SO2 to SO3 and subsequent removal of the latter by condensation with water to form H2SO4 or by adsorption on activated coal is mentioned. Studies are presently underway in East Germany on the binding of SO2 to alkaline substances such as ash.

5104 APTIC NUMBER 14631

METHOD FOR THE COMPLETE REMOVAL OF NITROGEN OXIDES. (Werkwijze voor het volledig verwijderen van stikstofoxyden). Text in Dutch. (Hibernia-Chemie G.m.b.H., Gelsenkirchen-Buer, West Germany and Harry Pauling, Munich) Dutch Pat. 6,606,577. 13p., Nov. 21, 1966. (Appl. May 13, 1966, 23 claims).

The invention describes a method for the complete removal of nitrogen oxides from waste gases using ammonia with recovery of nitrogen as ammonium nitrate. First, the nitrogen oxides are completely oxidized and the mixture of NO and NO2 is washed with ammonium nitrate solution of fixed maximum and minimum ammonia content, i.e., a maximum water vapor: ammonia ratio of 2:1 and a minimum ratio of 100:1. The ammonium nitrite-containing solution obtained is converted into ammonium nitrate solution with the help of nitric acid. The concentration of ammonium nitrate in the solution should be so high that its viscosity is equal to or greater than that of water at the same temperature; at a working temperature of 20-30 C, this concentration should be from 40 to 50% by weight. There should be at least two, and preferably three or more washers and the solution passing through the scrubbers should contain at least 0.5-5% by wt free ammonia. Each washing stage in the gas washer installations should have its own inlet and outlet so that they are connected in series in the direction of gas flow and in parallel in the direction of solution flow. The degree of oxidation of the gas, after passing through half or 2/3 of the washing stages, is corrected to 50%. A washing stage with mild nitric acid should be added after the washing stages with ammonia. The nitric acid content of the ammonium nitrate solution is fixed to be 0.5-1.5% and never to exceed 3%. The solution is vigorously stirred after mixing with air circulation. The nitric acid ammonium nitrate solution is circulated with one or more giant air pressure pumps and cooled if necessary.

5105 APTIC NUMBER 15526

Fitch, W. P., R. C. Ross, and W. P. McDuffie
TESTS OF VARIOUS PARTICLE FILTERS FOR REMOVAL OF OIL MISTS AND HYDROCARBON VAPOR. Oak Ridge National Lab., Tenn., ORNL-TM-1623, 26p., Sept. 7, 1966.
CFSTI: TM 1623

Various filter and adsorbent materials were examined for possible use in removing oil mists and hydrocarbon vapors. A controlled flow of oil was injected into a heated nickel reaction vessel to cause vaporization and some cracking of the oil. Helium flowing through the reaction vessel carried the oil mist and hydrocarbon vapor through a filter system. Filter effectiveness was determined by the use of a hydrocarbon detector, gravimetric analysis, and gas chromatographic analysis. Good removal of mists was achieved by the use of a combination of felted metal fibers, and ceramic fibers in a configuration proposed for use in the molten salt reactor experiment. Granulated charcoal removed hydrocarbon vapors (C6 and above) in a manner consistent with the established adsorption isotherms for this material. (Author abstract modified)

5106 APTIC NUMBER 14425

Hodgkiss, J. R.
SOME ASPECTS OF AIR POLLUTION AND THE CEMENT INDUSTRY. S. African Mech. Eng. (Johannesburg), 18(10):265-267, May 1969. 4 refs.

The ways in which dust can be suppressed or collected at almost every stage of the cement-making process are illustrated. These methods are designed to meet the requirements of the South African Air Pollution Prevention Act of 1965. Major sources of dust to be controlled include the quarrying of raw materials, the crushing plant, mill ventilation, stack emission from the burning process, coal drying and grinding, bagging and dispatch, in-plant transport systems and storage of raw materials, and surface dust on roads and roofs. Particular attention is given to the cyclone system for mill ventilation, the electrostatic precipitator used to reduce stack emissions from the kiln, and the stack whose height and diameter were determined after theoretical calculations of dust deposition patterns. The installation of cyclones to remove coarse particles and of additional plates and electrodes on the precipitator commissioned in 1966, have reduced stack emissions to 86 mg/cu m at standard temperature and pressure.

5107 APTIC NUMBER 14610

Hohmann, Hans
PROCESS AND EQUIPMENT FOR THE REMOVAL OF SULFUR DIOXIDE AND TRIOXIDE FROM FLUE OR STACK GASES. (Verfahren und Einrichtung zur Entfernung von Schwefeldioxyd und -trioxyd aus Rauch- bzw. Abgasen). Text in German. W. German Pat. 55743. 3p., Mar 5, 1967. (Appl. Aug. 25, 1966, 5 claims).

This patent concerns a process and equipment for the removal of SO2 and SO3 from flue gases with dry alkali earth carbonates, primarily calcium carbonate. This compound is known to adsorb SO2 and H2O from a SO2-containing moist gas atmosphere. The adsorbed water vapor serves as a solvent for SO2 at a relative gas humidity of 10 to 100%. Based on this process, the following desulfurization process was invented: Gaseous SO2 and SO3 are brought to reaction in a gas atmosphere of 50 to 100% relative humidity at temperatures from 0 to 80 C. The reaction follows the equation CaCO3 plus SO2 plus 1/2H2O yields CaSO3.1/2H2O plus CO2. Since reaction speed and quantity of sulfite formation depend on the activation of a catalyst, special equipment was invented. An air-swept mill is installed between emission source and stack. Here, the limestone is dried and ground in one process. New adsorbing surfaces are continuously created by grinding. Drying of the limestone grains increases the specific surface, and a maximum phase boundary surface is obtained. The main reaction takes place in the outlet of the air-swept mill, where a suitable substance exchanger is attached, e.g., uptake with subsequent cyclone and/or filter.

5108 APTIC NUMBER 15709

Hough, Gerald W. and Lyle J. Gross
AIR EMISSION CONTROL IN A MODERN PULP AND PAPER MILL. Am. Paper Ind., 51(2):36-37, 80-82, 84. Feb. 1969. 18 refs.

Increasing concern about the environment in the U. S. is causing federal, state, and local governments to legislate increasingly stringent laws governing emissions from industrial plants. The concepts which a pulp and paper mill can adopt to reduce emissions to levels which have been proven to be attainable are discussed. The amount of water vapor, particulate matter, and sulfur emissions in pounds per ton of pulp from each operation of the kraft pulp mill is compared before and after application of suitable controls. Air emission control systems increase both the capital and operating costs of pulp mills. Order of magnitude capital cost estimates for the air emission control equipment for a new 500 tpd pulp mill are presented.

5109 APTIC NUMBER 15250

Hrabowecki, Mykola
METHOD AND APPARATUS FOR CONSUMING COMBUSTIBLE GASES IN ENGINE EXHAUST GASES. (Assignee not given.) U. S. Pat. 3,468,120. 10p., Sept. 23, 1969. 6 refs. (Appl. April 25, 1967, 6 claims).

An efficient and inexpensive secondary combustion device is described which consumes essentially all carbon monoxide gas before it is expelled from the cylinder exhaust ports or openings at the engine block of an internal combustion engine. The invention provides a novel method and apparatus for using the heat of exhaust emerging from the engine along with naturally drawn air intermingled with the hot exhaust to achieve substantially complete secondary combustion of residual carbon monoxide and unburned carbon particles. The exhaust gases are ignited in a burner chamber at the exit of each cylinder of an internal combustion engine. The reburned exhaust gases are passed through individual circulating chambers and then isolated chambers having a volume approximately equal to the volume of exhaust gases emanating from each cylinder during an exhaust stroke. The exhaust gases from each cylinder are merged according to the order of firing of the cylinders into an exhaust tube to prevent back-pressure in the isolated chamber. The apparatus for achieving complete secondary combustion of the residual carbon monoxide embodies a venturi action adjacent to the exhaust valve of the engine cylinder induced to draw air by natural draft into the region of the venturi throat in the form of an annular converging stream where air is thoroughly mixed with hot exhaust from the cylinder.

5110 APTIC NUMBER 14947

Hukui, S. and A. Yamamoto
STUDIES ON THE CORROSION OF METALLIC MATERIALS BY POLLUTED AIR. (Okentaiki nivoru kinzokuzairyo no fushoku nikansuru kenkyu). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(5):28-44, June 1969. 9 refs.

Twenty-nine metals with or without plating or coating were exposed to the atmosphere for a year at 13 locations from Kanto to Kyushu. Corrosion varied to a great extent and was more severe where the air was more polluted. The order of decreasing corrosion of metals was mild steel, high tensile strength steel, stainless steel, and aluminum. Corrosion was related to the amount of SO2 in the air and also the amount of SO4(2-) and Cl(-) ions in the dust. The rate of corrosion could be estimated by the lead dioxide method. Zinc-plating reduced the corrosion of mild steel by 99% and remained effective in a highly polluted area. Coating was extremely effective even in highly polluted areas if the number coats was great enough and free of defects. For the purpose of reducing the test period to 60-80 days, corrosion was enhanced by acute exposure to SO2 or by weather meter. Neither of the two tests correlated well with the atmospheric test, because atmospheric corrosion is due to the joint effects of meteorological factors and pollutants, and a more complex test is required to simulate these conditions. Both tests, however, were found to be extremely effective for quality control. It is concluded that corrosion can be prevented by the proper choice of metal and coating, based upon the estimated amount of corrosion calculated from lead dioxide measurements.

5111 APTIC NUMBER 14889

Huysman, F. and A. Maubon
IMPROVEMENT IN THE REMOVAL OF DUST FROM WASTE GASES OF OXYGEN STEEL CONVERTERS BY EXTRACTION BEFORE COMBUSTION. (Amelioration de la technique de depoussierage des gaz residuels de convertisseurs a l'oxygene par captage sans combustion). Text in French. Rev. Met. (Paris), 65(5):333-343, May 1968. 11 refs.

At the Dunkerque works, carbon monoxides are evolved when steel is refined by blowing oxygen through the melt for about 18 min. A relatively new control technique, used for four years, is to collect the combustible gas without letting it burn at the converter mouth. The collector is a 'skirt' surrounding the mouth, whose internal pressure is adjusted so that just a little air is drawn in at the point of contact with the converter. The temperature of the gas is about 1630 C. The skirt can be raised during the process so that the controllers can inspect the effluent gas. The necessary pressure drop was a few mm of water. The rate of flow in the apparatus is large, so that at the beginning and end of refining, a plug of completely burnt gas separates carbon monoxide from air by intervening between them in the flow and thus prevents explosions. The gas is cooled in an exchanger and then scrubbed in a saturator and washing tower using about 500 cu m of water/hr. Sludge is decanted off, the residue is centrifuged, and the water is recycled. The residual dust content is about 100 mg/N cu m. In four years of operation, the original gas collector, with the joint to the converter sealed with steam, was abandoned for the movable skirt. The introduction of an oxygen injector with three differently directed holes lessened the ejection of metal and slag froth into the gas collector and eliminated blockage. A refractory soot collector was substituted for the first heat exchanger. The jets of the scrubber were redesigned to avoid blocking by the recycled water. The carbon monoxide which evolved from the washing water was directed away from all the work places, however, one small explosion occurred. Old safety valves were replaced by stainless steel valves. The minimum pumping speed was increased to 35,000 cu m/hr. Pumping and lowering of the skirt are never begun before absorption of oxygen has started.

5112 APTIC NUMBER 13737

Ibrahim, Karen
POLLUTION: THE PRESSURE IS ON. Graphic Arts Progr., 15(4):6-15, April 1968. 31 refs.

Air pollution is an important issue in both the printing and pulp-and-paper segments of the graphic arts industry. The main pollutant of the printing industry is the gaseous emission of solvents (aromatic hydrocarbons) from the dryers. Attempts are being made to control the pollution by thermal or catalytic combustion or by the use of adsorption devices. Thermal combustion involves the direct burning of the effluent in a gas-fired incinerator which is effective in eliminating pollution but at present is economically unfeasible. Catalytic combustion differs from thermal combustion in that it is flameless. Adsorption devices utilize activated carbon as the adsorbent; and this method is also economically unfeasible. Another method for solvent-pollution control is the development of mild or low-aromatic nonoffending solvents. Pulp and paper-makers are primarily concerned about the emission of gases which contain sulfur, mainly SO2 and H2S. Among control methods are (1) proper operation of recovery furnaces and (2) installation of black liquor oxidation units or forced-circulation evaporators. The difficulties in proper monitoring and sampling, in setting standards, and in paying for control equipment and its operation, in both areas of the graphic arts industry are stressed.

5113 APTIC NUMBER 13518

Ingram, G.
THE USE OF SILVER VANADATES AS ABSORBENTS FOR SULPHUR DIOXIDE. Anal. Chim. Acta, 3:137-143, 1949. 5 refs.

Laboratory preparation of a solid absorbent for sulfur dioxide is described. The absorbent is effective at room temperature and does not absorb carbon dioxide. Exhaustion of the filling is indicated by a change in color from green to brown. The reagent is prepared by heating molecular quantities of silver oxide and silver metal vanadate together at 150 C. The two silver salts combine, forming a product having the same empirical composition as silver or the vanadate but with different properties.

5114 APTIC NUMBER 15513

Jackson, Marvin W.
EXHAUST HYDROCARBON AND NITROGEN OXIDE CONCENTRATIONS WITH AN ETHYL ALCOHOL-GASOLINE FUEL. Preprint, Society of Automotive Engineers, Inc., New York, 33p., 1968. 29 refs. (Presented at Society of Automotive Engineers Summer Meeting, Chicago, June 8-12, 1968.)

The exhaust hydrocarbon and nitrogen oxide concentrations of a single-cylinder engine operating on a 25% wt ethyl alcohol-75% gasoline fuel are compared to those of the same engine operating on gasoline. Comparisons at an air-fuel ratio below 15.3 indicate that adding ethyl alcohol to gasoline reduces exhaust hydrocarbon concentrations but increases nitrogen oxide concentrations. At an air-fuel ratio higher than 15.3 ethyl alcohol reduces both hydrocarbon and nitrogen oxide concentrations. However, tests at the same air-fuel ratio indicate that ethyl alcohol increases surge and, in some cases, results in a power loss. To overcome these performance problems, the ethyl alcohol-gasoline fuel must be operated at about the same percent theoretical air as gasoline and comparative tests at the same percent theoretical air show that the additive has little effect on exhaust hydrocarbon and nitrogen oxide concentrations. The fuel mixture offers no promise for reducing pollution by automobiles. (Author abstract modified)

5115 APTIC NUMBER 15902

Jaeger, Walter and Ashutosh R. Majumdar
REMOVING SO2 FROM STACK EMISSIONS. Nat. Eng., 73(11):16-18 Nov. 1969.

A new wet scrubbing process for the simultaneous removal of SO2 and fly ash from the tail gas of power plants is based on the use of a separator in which gases are intensively mixed with a water-alkaline solution, distributed into very narrow layers, and then subjected to a high linear acceleration followed by deceleration. The acceleration and deceleration steps break down high surface tension between particles, making it possible for the rinse liquid to pick up particulate matter. The enriched rinse liquid, which is recycled through a settling tank, becomes saturated with fly ash that is removed by vacuum filtration or other separation methods. Part of the fly ash and 60-70% of the SO2 are absorbed in a packed cooling tower placed in front of the separator. The remaining SO2 is washed out of the separator by the rinse liquid. The main absorption process is the conversion of sulfite to bisulfite. Absorption with ammonia is recommended since ammonium sulfite can be easily oxided to salable ammonium sulfate.

5116 APTIC NUMBER 14894

Jafs, Daniel
RECOVERY OF HEAT AND CHEMICALS IN FLUE GASES UTILIZING THE WARKAUS VENTURI SYSTEM. Paperi Puu, 48(6):337-339, 341-342, 1966. 19 refs.

Expressions are derived for establishing optimum operating conditions in a Warkaus venturi. The construction and its mode of operation of the venturi are described. A typical unit consists of a converging inlet, a venturi throat, a diverging outlet, a droplet separator, and a stack. The droplet separator can be of the lamella or cyclone type. Utilization of the venturi for recovery of heat and chemicals from flue gases is illustrated by actual cases showing efficiencies of 90-99%, and ranging as high as 99.99% for a three-stage system. The odor reduction potential is also emphasized. The system is well suited for the scrubbing of flue gases containing organic sulfur compounds and recovery of salts and sulfur compounds in the sulfite industry. It can also be used as a lime kiln scrubber, as an evaporator rectifying black liquor from 45-60% dry solids, and as a reaction chamber. It is also possible to oxidize certain spray liquors with air or flue gases containing an excess of oxygen.

5117 APTIC NUMBER 15356

Jahn, Fredrik Wexelsen de
PROCEDURE FOR REDUCTION OF SULFUR DIOXIDE TO SULFUR. (Procede pour la reduction de l'oxyde sulfureux en soufre). Text in French. (Assignee not given.) French Pat. 854,116. 6p., April 15, 1940. (Appl. Dec. 13, 1938, 6 claims).

The reduction of sulfur dioxide is effected by the action of producer gas at a high temperature. If SO2 is contained in a gas mixture resulting, for example, from the reduction of calcium sulfate, one first eliminates the gases other than SO2 and then introduces the producer gas in an amount approximately equal to that of the eliminated gases. To eliminate these gases, one utilizes the sensible heat of the producer gas as well as the heat of reaction of the constituents of this gas with the SO2. Gas containing the SO2 is scrubbed before being admitted into the reaction chamber. For reduction of SO2, the mixture of SO2 and the producer gas is passed in the reaction chamber over a catalyst which includes a metal or a metal compound chosen within groups VIII, V, or IV of the periodic table of elements. In particular, the catalyst may consist of a mixture of oxides of Fe, Mg, and Cr.

5118 APTIC NUMBER 14707

Jelen, M.
DEVICES AGAINST DUST NUISANCES. (Zarizeni proti prasnosti). Text in Czech. Ochrana Ovzdusi, no. 3:33-41, 1969.

Fuels used for power production in Czechoslovakia have a high ash and sulfur content. They are contributing to pollution of the lower atmosphere, affecting the health of workers and the productivity of industrial enterprises. Early conversion to gaseous or liquid fuels is not foreseen, but fuel dusts can be substantially reduced by dust collectors. Efficient collectors exist, and more funds must be provided for their maintenance and for disposal of the harmful substances they collect. When equipment is properly maintained, these substances represent valuable raw materials that can be returned to the industrial process. Industrial works at Milevsko, Liberec, and Nove Mesto produce mechanical and wet collectors, electrostatic precipitators, filters, and accessories required for efficient operation. This equipment is described in detail, together with the operating parameters of each item. Further research and development in this field continues.

5119 APTIC NUMBER 14996

Johnstone, H. F.
METALLIC IONS AS CATALYSTS FOR THE REMOVAL OF SULFUR DIOXIDE FROM BOILER FURNACE GASES. Ind. Eng. Chem., 23(5):559-561, May 1931. 7 refs.

The preliminary results are given of attempts to increase the solubility of sulfur dioxide in water to such an extent that the amount of water required for the removal of SO2 would be reduced to a point that would make the process economically and mechanically feasible. The production of sulfuric acid from the sulfur compounds in the gases being scrubbed was also studied. Air containing 0.325% SO2 was passed at a constant rate through 3 liters of water containing the catalyst. The sulfates of iron, manganese, and nickel and various combinations of these and with copper, zinc, and chromium were used as catalysts. Nickel ions showed no catalytic effect in concentrations up to 1.5 grams/l. Manganese ions, in concentrations as low as 0.0028%, exerted a strong catalytic action which increased the capacity of the water to absorb SO2 by approximately 600%. The catalytic effect of ferric ions was somewhat less than that of manganese. Definite promoter action was shown when a very small concentration of manganese was added to dilute ferric solutions. It was found that the presence of a trace of copper ions completely inhibits the action of manganese in any concentration. Removal of the copper by precipitation as copper sulfide was not sufficient to prevent the inhibition. Copper ions, however, had no effect on catalysis by ferric ions. The presence of the copper ions in zinc, nickel, chromium, and the alkali metals neither inhibited nor promoted catalysis by manganese. The effect of the presence of manganese ions on the capacity of the washing water for absorbing sulfur dioxide showed that although the efficiency of the washer operating on flue gases was a great deal lower than that of the laboratory scrubber, it compared favorably with the efficiency obtained by other large scale methods.

5120 APTIC NUMBER 14979

Johnstone, Henry F.
PROCESS OF REMOVING SULPHUR DIOXIDE FROM WASTE GASES.
(Commonwealth Edison Co., Chicago, Ill.) U. S. Pat. 2,138,881. 6p., Oct. 25, 1938. (Appl. Dec. 23, 1935, 1 claim).

A process is described for removing sulfur dioxide from waste gases containing 0.1% sulfur dioxide. The gases are reacted with an aqueous solution of ammonium sulfite and ammonium bisulfute at 85 C, the solution containing between 11-14 moles of ammonia per 100 moles of water. The mixture is then heated to 100 C to liberate the sulfur dioxide and regenerate the solution for reuse.

5121 APTIC NUMBER 15335

Jones, Allen R. and Edward P. Reed
DUST COLLECTING APPARATUS. Sly, W. W. Manufacturing Co., Inc., Cleveland, Ohio) U. S. Pat. 3,853,810. 6p., July 8, 1969. 8 refs. (Appl. Jan. 16, 1968, 10 claims).

A sealing device which eliminates metal-to-metal sliding contact and reduces the leakage or pressurized air along the top and bottom ends of wiper blades in dust collecting apparatus is described. The dust collector includes a frame, dust collecting bags, pneumatic sealing rails mounted on the frame, and a traveler mounted on the frame. The traveler is used for directing a supply of pressurized clean air into the open ends of the bags for the removal of dust trapped on the exterior surface of the bags. The sealing rails aid in directing the clean air into the bags. The traveler is provided with spaced blades adapted for co-acting engagement with the open ends of the bags when the traveler moves relative to the frame. The sealing device is attached to the traveler and comprises a pair of oppositely located supports. Each support has a flat strip of rubber-like material which extends the length of the support. One edge of the rubber material is in contact with the sealing rails. In addition, the supports have U-shaped strips positioned side-by-side lengthwise along the support. The U-shaped strips have a bight and a pair of flaps. The bight is spaced slightly apart and overlaps the ends of the blades. The flaps project away from the supports toward the traveler into spaces between the blades. The U-shaped strips are positioned so that the bight slides along the upright portion and the flaps slide along the inclined portion of the rails. This arrangement results in pressure on the inside face of the strips always being greater than the pressure on the outside face of the strips which causes the strips to deform under the force of pressurized air and improve the seal. The device is compact and can be easily installed or removed as a unit.

5122 APTIC NUMBER 14952

Kameko, Atsuya
AN EXPERIMENTAL REPORT ON THE NEWLY DEVISED LUFTALLFILTER INSTALLED IN OSUMIGASEKI BUILDING. (Mitsui kasukigaseki biru no rufutorufiruta secchi rei). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7(1):59-69, April 1969.

Theory of operation, structure, and practical efficiency of the Luftallfilter were investigated. It is widely acknowledged that there is an urgent demand for high-fidelity air conditioning in today's multistory buildings. An ordinary air filter was compared with an electric system air filter and it was concluded that the electric system air filte/ is superior with regard to its efficiency of dust collecting and ease of cleaning. The research data were collected from Dec. 1966 to Oct. 1967 and show that the Luftallfilter guarantees stabilized efficiency, accurate measurement of dust collection, reliability of operation, and easy maintenance. For example, the mechanical air filter does not collect dust below 5 microns, and 80-85% of dust in the air is under 5 microns. The electric air filter collects these small particles. Cleaning of the mechanical air filter is complicated and it needs frequent cleaning, but the electric air filter needs cleaning only once a year.

5123

APTIC NUMBER 14226

Kamino, Yasumi, Shigenori Onizuka, Kenji Yasuda, Masaaki Miyaji, and Yoshihide Kawamura
REMOVAL OF SO2 GAS IN EXHAUST GAS BY STEAM-GENERATED ACTIVATED CHARCOAL PROCESS (III) DESORPTION OF SO2 GAS BY STEAM. Translated from Japanese. Hitachi Shipbuilding Co. (Japan), p. 1422, (1968).

Since the absorption capacity of activated charcoal drops gradually as it absorbs a greater volume of sulfur dioxide gas, the charcoal must be regenerated by desorbing the SO2 from it. For this purpose the Reinluft process uses high temperature inert gases and, in large projects, rinsing. This paper describes an attempt to obtain the same results by using superheated steam at about 100 degrees C. The interrelation is shown between the condition of absorption and the weight or composition of the absorbed gas.

5124

APTIC NUMBER 14950

Kamiyama, Hiroshi, Seiichi Kano, and Tojiro Kuboyama
A METHOD FOR DESULPHURIZING GAS. (Gasu datsuryu hoho). Text in Japanese. (Mitsubishi Kasei Kogyo Co., Tokyo) Japanese Pat. Sho39-9735. 5p., May 7, 1969. 2 refs. (Appl. March 30, 1961, 1 claim).

In this method, hydrogen sulfide-containing gas is absorbed in an alkaline solution of quinone or of highly oxidizing aromatic compounds with hydroxide or nitro- groups substituted in the nucleus. The solution is subsequently brought into contact with oxygen in the presence of an iron-base catalyst and regenerated. During this process, sulfur is separated from the solution and the regenerated alkaline solution is circulated for repeated use. In an example of industrial application of the process, sodium carbonate solution with hydroquinone was poured from the top of a desulfurization tower filled with packing material. Coke oven gas was introduced from the bottom of the tower. The desulfurizing solution contacted the rising coke oven gas while flowing down through the packing material. After absorption, the solution was removed from the tower through the bottom to the top of the regenerating tower filled with the iron catalyst. Oxygen or air was introduced into the tower from the bottom. Sodium carbonate was regenerated in the desulfurizing solution, and the sulfur precipitated and was recovered by filtration. The regenerated absorbing solution was recycled to the desulfurization chamber for repeated use. A continuous operation of the process removed hydrogen sulfide from the gas with great efficiency.

5125

APTIC NUMBER 13750

Kanukov, P. Kh. and I. A. Podina
AUTOMATIC REGULATION OF THE PROCESS OF CHLORINE PURIFICATION AT THE 'ELEKTROTSINK' FACTORY. (Avtomaticheskoye regulirovaniye protsessa khlornoy ochistki na zavode 'Elektrotsink'). Text in Russian. Tsvetn. Metall. no. 6:81-85, 1968.

Flow diagrams are given for two processes for automatic regulation of chlorine purification in the zinc and lead refining industry. Up to 500 mg/L chlorine is produced in the process, corroding the condenser tubes and affecting the anodes. The solution is purified by adding copper pulp which acts to form a Cu2Cl2 precipitate. The process was formerly checked periodically in the laboratory for chlorine removal--the solution must contain 180-190 mg/L chlorine and 3-5 g/L H2SO4. In 1963-65, in a factory in the Caucasus, an electronically remote-controlled system was adapted (diagrammed) in which acidity was monitored by a pH meter and chlorine by polarographic assay.

5126

APTIC NUMBER 15256

Karsten, Otto
DEVICE FOR ADDITION OF DOLOMITE HYDRATE DUST TO WASTE GASES FROM FIRING SYSTEMS FOR THE PURPOSE OF REDUCING THE SO2 AND SO3 CONTENT. (Vorrichtung zum Einbringen von staubfoermigem Dolomithydratin die Abgase von Feuerungsanlagen zum Zweck der Herabsetzung ihres SO2 - und SO3-Gehaltes). Text in German. (Vereinigte Kaliwerke Salzdetfurth, AG, Hanover) W. German Pat. 1,260,668. 3p., Feb. 8, 1968. 1 ref. (Appl. March 14, 1968, 3 claims).

A device for apporting dusty hydrate for injection into waste gases to remove SO2 and SO3 is described. It consists of the additive container equipped with a shaking, or pneumatic loosening, device. Underneath the container is a grooved roller. Upon shaking of the container, the additive falls onto the roller and into the grooves. As the roller rotates any excess additive is brushed off by the edge of the container. The grooves carry measured quantities of the additive, which is drawn off by an exhaust fan and injected in the form of dust-laden air. The speed at which the roller driven by a variable speed gearing, rotates depends on the amount of additive needed. Adjustments are made automatically. For example, 50 kg dolomite hydrate (particle diameter less than 0.002 mm) distributed by a roller (diameter 300 mm, 94 grooves) at a rate of 22 kg/h and injected into a waste gas containing 200 mg SO3/cu m reduces this content to 50 mg/cu m.

5127

APTIC NUMBER 15036

Katell, S.
REMOVING SULFUR DIOXIDE FROM FLUE GASES. Chem. Eng. Progr., 62(10):67-73, Oct. 1966. 9 refs.

Estimated capital investment and operating costs for three dry processes for removing sulfur dioxide gas are projected for an 800-Mw. power plant burning a 3% sulfur coal. Many of the projections are based on actual operating data, although some may be optimistic. The capital investment is the lowest with the alkalized alumina process-$8,510,000 compared with $14,217,000 for the Reinluft, and $16,999,000 for the catalytic oxidation process. On a dollar per kilowatt-hour basis these numbers are, respectively, 10.68, 17.77, and 21.25. The operating costs, which include capital charges of 18% of total investment for a

90% operating load, are lowest for the alkalized alumina process. On an annual basis they are $3,402,000 compared with $3,881,000 for the catalytic oxidation and $5,431,000 for the Reinluft process. Expressed as mills per kilowatt-hour and dollars per ton a coal, the operating costs are 0.537, 0.613, and 0.857 mills/kw.-hr. and $1.54, $1.75, and $2.45/ton of coal. In mills per million Btu the corresponding numbers are 60.0, 68.4, and 95.8. On a 50% operating load the operating costs change appreciably. They are lowest for the alkalized alumina process. $2.18/ton of coal compared with $3.02 for the catalytic oxidation and $3.58 for the Reinluft process. (Author conclusions modified)

5128 APTIC NUMBER 14954

Kenya, A.
ON THE DIFFUSION OF FLUE GASES FROM CHIMNEY. (Haien no kakusan ni tsuite). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(7):2-12, July 1969. 7 refs.

By creating an effective diffusion of flue gas from chimneys, air pollutants can be diluted one hundred thousand times; the other methods of removing pollutants from fuels in the combustion process dilute them to only one-tenth to one-fiftieth. Two important factors to be considered are a large upward momentum of the smoke and diffusion of the smoke in the atmosphere. Rosanquet's equation is shown as a basis for calculating the maximum height the smoke can attain at a given momentum. Five types of meteorological effects on smoke, i.e., looping, coning, fanning, lofting, and fumigation are explained. Sutton's equation is employed as a basis for calculating diffusion. Sufficient chimney height, large exit velocity and volume of the flue gas, and high temperature are essential for effective diffusion. The importance of replacing a number of small chimneys by a single tall one is emphasized. Choice of chimney heights and criteria for exit velocity are given. When a new plant is to be built, geographical and meteorological conditions of the plant site, flue gas conditions, height and location of chimneys with respect to other buildings, theoretical calculation, and experimental measurement of pollutant concentration, together with observations made at the plant site, are to be considered. Maintenance and replacement of chimneys are also explained and illustrated with practical examples.

5129 APTIC NUMBER 14976

Kercher, H.
RESEARCH IN THE FIELD OF DUST REMOVAL ENGINEERING. (Forschung auf dem Gebiet der Entstaubungstechnik). Text in German. Brennstoff-Waerme-Kraft, 21(5):273-274, May 1969. 1 ref.

At a meeting sponsored by the VDI (Association of German Engineers) work group on dust engineering, dry and wet dust collectors and electrostatic precipitators were discussed. Comparison between a cyclone and a rotary flow collector points to the fact that the latter attains higher collection efficiencies but also has higher pressure losses. In a paper presented by H. Reichert, an attempt was made to find the optimum dimensions of cyclone separators with the aid of mathematical models. However, it was found that the method is controversial, since simplifying assumptions have to be made whose impact on the practical situation cannot be anticipated. In the example presented at the meeting, the dust was neglected and the computation yielded much longer cyclones than those used in practice. Discussion of electrostatic precipitation stressed that low-ohmic dust particles (fly coke) embedded in a high-ohmic layer of fly dust impair effective operation of the precipitator. A new type of electrostatic precipitation was reported. Monodisperse aerosols are ionized by two polonium-containing substances and precipitated. Good collection efficiencies were achieved with an ac precipitator. Higher precipitation speed than in high-voltage dc precipitators was achieved with such a filter. Discussion of wet collectors led to the conclusion that a good contact between the solid and liquid phase is more important than the wetting capacity of the dust particles.

5130 APTIC NUMBER 15155

Kercher, Hermann
THE REDUCTION OF STACK EMISSIONS AT POWER PLANTS THROUGH DUST SEPARATION IN ELECTROSTATIC PRECIPITATORS. (Die Verminderung des Schornsteinauswurfs bei Kraftwerken durch elektrostatische Entstaubung). Text in German. Energie (Munich), 21(9):279-86, Sept. 1969. 11 refs.

After reviewing the legal limits (150 mg/standard cu m at new plants) set for dust emissions by power plants and various means for dust separation, e.g., cyclones, cloth filters, wet dust separators etc., attention is focused on the electrostatic precipitator. Primary factors which reduce the collection efficiency, and measures to avoid them, are discussed. The collection process in the electrostatic precipitator is theoretically expressed in the Deutsch formula, which is based on two presumptions: in each field cross section perpendicular to the main flow, the unprecipitated dust is uniformly distributed, and the dust precipitated on the collection electrodes is not reagitated. According to the Deutsch formula, the larger-sized unit has the higher collection efficiency and a low gas speed increases its efficiency. Adequate gas flow into the precipitator is also highly important. The gas must be ionizable. Pure nitrogen does not have this property, but O2, SO2 and H2O molecules are ionized easily. Higher gas temperature increases the mobility of the ions, but above 200 C the gas viscosity impairs the speed of particle movements. Dust particles with a high fraction of incombustible substance and very fine dust collector reduce efficiency, while uniform dust and gas distribution improves the performance of the precipitator. Shaking intervals should be chosen in agreement with the thickness of dust accumulating in the various sections of the collection electrodes. Backscattering, caused by high dust resistance, can also reduce the collection efficiency. The light extinction method of measuring dust resistance and dust concentration is briefly reviewed.

5131 APTIC NUMBER 14779

Kernan, John J.
SMOKELESS COKE OVENS. (Assignee not given.) U. S. Pat 3,462,346. 6p., Aug. 19, 1969. 8 refs. (Appl. Sept. 14, 1965, 6 claims).

Because retort (by-product recovery) processes are much more costly, interest is again centering on non-recovery processes for manufacturing coke. A new coke oven reduces the smoke and atmospheric contamination produced by earlier non-recovery processes and requires no external source of heat other than that produced in the oven. Green coal and hot coke are cooked in adjacent chambers, and smoke resulting from the incomplete combustion of the green coal is lead to the hot-coke oven where it is almost completely burned before passing to the stack. Before passing through the stack, hot gases from both chambers are passed underneath the chamber containing green coal so that both the bottom and the upper portions of coal are heated. As a result, the speed of the coking process is materially increased.

5132 APTIC NUMBER 14768

Kerr, John
REMOVAL OF SULPHUR DIOXIDE FROM FLUE GAS. (Peter Spence & Sons Ltd., Widnes, England) U. S. Pat. 3,458,358. 4p., July 8, 1969. 8 refs. (Appl. April 5, 1966, 6 claims).

A method for removing sulfur dioxide from flue gas is described. Five percent by weight SO2 in the flue gas reacts with a mixture of hydrogen sulfide and carbonyl sulfide in the presence of a catalyst. Elemental sulfur is deposited on the catalyst and the catalyst is recycled to produce hydrogen sulfide and carbonyl sulfide from the elemental sulfur. In mixtures containing less than 1% sulfur dioxide by weight, a hydrocarbon is reacted with steam to form a mixture of hydrogen and carbon monoxide. This mixture is reacted with the sulfur in the catalyst regeneration zone and hydrogen sulfide, carbonyl sulfide, and sulfur vapor are formed. Sulfur vapor from this mixture is removed. The flue gas stream which contains the sulfides is passed through a reaction zone containing an activated alumina catalyst. Sulfur is deposited on the catalyst from the reaction of the sulfides and the sulfur dioxide from the flue gas. This catalyst is also regenerated for reuse.

5133 APTIC NUMBER 13757

Khar'kovskaya, Ye. N., Ya. D. Zel'venskiy, and R. N. Pronina
LOW TEMPERATURE PURIFICATION OF NATURAL GAS FROM SULFUR COMPOUNDS WITH ABSORBENTS BASED ON OXIDES OF ZINC AND COPPER.
(Nizkotemperaturnaya ochistka prirodnogo gaza ot sernistykh soyedineniy poglotitelyami na osnove okislov tsinka i medi). Text in Russian. Khim. Prom. (Moscow), 44(7):514-516, 1968. 9 refs.

Natural gas purified to a sulfur content of less than 1 mg/cu m was the goal of these experiments. Various types of zinc oxide were tested to obtain a product with the highest absorptive capacity. The absorbent was prepared as follows: Zinc-containing mine tailings were washed free of sodium salts, dried and roasted at 350-400 C. Cuprous oxide (5-50%), graphite (1%), and water (5%) were added to the zinc oxide; the mixture was then made into tablets 4-5 mm in diameter and 2.5-3 mm in height. The optimum cuprous oxide content was 10-15%. Absorbability of the zinc oxide with this amount of cuprous oxide was higher at a lower temperature (250 deg) than with zinc oxide alone. These absorbents and others like them were tested on various models of absorbing equipment and with various types of natural gas with differing sulfur contents. In one typical test, a type 'GIAP-10-2a' absorber was used, pressure was 20 atm, temperature was 280-300 deg, the volume rate was 1000/hr, the flow rate was 1 cu m/hr, the height of the absorbing layer was 40 cm, and the sulfur content of the gas was 8-25 mg/cu m. Complete purification was obtained for 6 months under these conditions.

5134 APTIC NUMBER 13751

Khar'kovskaya, Ye. N., V. T. Yagodkin, R. N. Pronina, M. L. Dantsig, and T. G. Kondrat'eva
PURIFICATION OF NATURAL GAS FROM SULFUR COMPOUNDS WITH ABSORBENTS CONTAINING ZINC OXIDE IN THE PRESENCE OF HYDROGEN. (Ochistka prirodnogo gaza ot sernistykh soyedineniy poglotitelyami na osnove okisi tsinka v prisutstvii vodoroda). Text in Russian. Khim. Prom. (Moscow), 44(8):593-595, 1968. 8 refs.

When natural gas was treated with hydrogen in addition to purification with zinc oxide, the higher molecular weight sulfur compounds were decomposed and removed. In a laboratory scale process, methane containing 7 vol. % sulfur was purified at atmospheric pressure and 400 C to 99.7-99.9%. The same high purification was obtained when the process was applied to natural gas on a pilot plant scale at 20 atm and 380-400 C. Best results commercially were obtained by the following process: preliminary use of a 'GIAP-10' absorber at 380-400 C, hydrogenation of the sulfur on an aluminum-nickel-molybdenum catalyst at 350-380 C, then removal of the hydrogen sulfide formed with a zinc-copper oxide absorber at 280-300 C. The lower temperature possible with this process was more feasible in industry. Use of this process in a pilot plant operation reduced the sulfur content of natural gas to less than 0.3 mg/cu m. The hydrogenation step could be combined with the absorption step by use of the following absorbent: 60.5% active ZnO, 3% MoO3, 2% CuO, 28% ammonium bicarbonate, 5% H2O, and 1% graphite. In the course of 6 months operation, natural gas was maintained at a purity of 96-99.8%. However, this process was not as effective as the separate hydrogenation.

5135 APTIC NUMBER 15349

Fijima, Harumitsu and Toshihiro Mori
A VENTILATED DUST COLLECTOR. (Haifu kanki shujin sochi). Text in Japanese. (Sumitomo Metal Industry Co., Osaka, Japan) Japanese Pat. Sho 44-12311. 2p., June 6, 1969. (Appl. April 21, 1966, 1 claim).

One end of a suction hood of a dust collector is U-shaped and is movable along a water tank. The water tank is divided by a diaphragm into two sections, one of which is open and the other closed. The hood enters the tank through the open section and leads the gas into the closed chamber. The gas is subsequently removed by a ventilator installed at an appropriate location along the tank. The device is particularly suitable for ventilating and collecting dusts along a long working area.

5136 APTIC NUMBER 10432

Kiyoura, Raisaku and Milton Munidasa
DESULPHURIZATION AND CONTROL OF AIR POLLUTION AS THE RATIONAL UTILIZATION OF HIGH SULPHUR CONTENT FUEL. Bull. Tokyo Inst. Technol., no. 98:1-11, 1969. 15 refs. (Presented at the 17th World Power Conference, Moscow, Aug. 20-25, 1968.)

The trends in fossil fuel consumption, air pollution due to sulfur oxides, and developments in the removal of sulfur from fossil fuel before and after combustion are explained. Immediate air pollution control measures would be the erection of taller stacks, utilization of low-sulfur content fuels, and the installation of flue gas and residual oil desulfurization equipment. However, the removal of sulfur has met a formidable cost barrier. The processes that are now under investigation deal mainly with the recovery of sulfur and sulfur compounds as by-products. Three processes being tested in Japanese pilot plants are the activated manganous oxide process, the charcoal adsorption process, and the contact oxidation process. In the activated manganese process, SO2 and SO3 react with powdered manganous oxide to form manganous sulfate. The absorbent, composed of manganous sulfate and manganous oxide, is collected by a multicyclone and an electric precipitator. Efficiency is good, but the method requires many stages and some loss of expensive chemical occurs. No data was available for the charcoal adsorption process, which consists of three absorbing, one washing, and two drying towers. Washing liquor is collected as weak H2SO4. The contact oxidation process consists of catalytic oxidation of SO2 followed by a gas phase reaction with ammonia. The overall efficiency is good and the recovered ammonium sulfate qualifies as a suitable fertilizer. The profit realized on the by-products would render the process economically feasible.

5137 APTIC NUMBER 15688

Kiyoura, Raisaku and Masaya Iguchi
INVESTIGATIONS AND RESEARCH ON THE EXHAUST GAS DESULPHURIZATION IN E.P.C.. REPORT OF A MEETING ON THE EXHAUST GAS DESULPHURIZATION OF A RESEARCH COMMITTEE OF E.P.C. (E.P.C. ni okeru haigasu datsuryu no chosa kenkyu. E.P.C. haigasu datsuryu kenkyu bunkakai no hokoku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(7):550-556, July 15, 1969. 11 refs.

The European Economic Community (E.E.C.) established a joint committee to investigate and study the desulfurization of exhaust gas. A number of desulfurization methods were considered including new methods being developed. They are, however, still in the stage of theory or experiment and need further study. The most promising methods have been tested on large or medium scale operations in Japan, America, and Germany. These methods and their costs are described, together with the problems of wet methods. The three methods developed in Japan are as follows: the activated charcoal method, in operation since March 1967; the Kiyoura-Tokodai method, where sulfurous acid gas in exhaust gas is oxidized to sulfuric acid in the presence of a catalyst, such as vanadium pentoxide, and eliminated as ammonium sulfate after reaction with ammonia; and the Mitsubishi method or DAP-Mn method, with a desulfurization rate of 90%. The Kiyoura-Tokadai method has a desulfurization rate of 93%; the collection rate of ammonium sulfate is 97.5% with a 99% purity. Among American methods are alkalized alumina, Combustion Engineering, and Monsanto methods. The desulfurization rate of the Combustion Engineering method is 83%, and its pressure loss is 150 mm water. German methods include furnace additives, the Reinluft, Still, Bischoff, Grillo, and Sulfacid methods. The problem of steam in the wet method is discussed, and the costs of the above methods are discussed in detail, together with the marketing of by-products.

5138 APTIC NUMBER 15091

Kiyoura, Raisaku, Haruo Kuronuma, and Gisuke Uenishi
PRODUCTION OF A CONTACT OXIDATION CATALYST FOR SULFUROUS ACID IN EXHAUST GAS. (Aryusanhaigasu no sessyoku sanka syokubai no seizoho). Text in Japanese. (Tokyo Inst. of Tech., Japan) Japanese Pat. Sho44-11781. 4p., May 29, 1969. (Appl. Dec. 22, 1965, 1 claim).

The industrial catalyst vanadium pentoxide - potassium sulfate is considered to be diffused on a solid carrier of silicic acid. Within the range of usual industrial reaction temperatures, this catalyst is satisfactory for sulfuric acid manufacture. However, it is not satisfactory with sulfurous acid, which is more dilute than sulfuric and contains more particulates which are difficult to eliminate. Both carbon and inorganic compounds, such as iron oxides, settle on the catalyst and reduce its active surface area. The new patented catalyst consists of vanadium pentoxide, potassium sulfate, potassium metaphosphate, and a trace of titanium oxide in a ratio of 1:1.5:0.25:0.01. Potassium metaphosphate reduces the vanadium pentoxide to the tetroxide and the ferric oxide to ferrous oxide, which fuses with the catalyst. Titanium oxide depresses the melting point of the catalyst and decreases its viscosity. This catalyst has an efficiency of 88% compared with 75% for the previously used catalyst.

5139 APTIC NUMBER 13743

Kiyoura, Raisaku, Haruo Kuronuma, and Gisuke Uwanishi
STUDIES ON THE RECOVERY OF SULPHUR DIOXIDE FROM HOT FLUE GASES, TO CONTROL AIR POLLUTION. Bull. Tokyo Inst. Technol., no. 81:1-5, 1967. 2 refs.

The Kiyoura-T.I.T. process utilizes the oxidation method to convert the SO2 of flue gases to SO3 in the presence of a vanadium oxide catalyst in a temperature range of 380 to 450 C. Water vapor present in the flue gas reacts with SO3

to form sulfuric acid. Ammonia is then introduced, at a temperature not lower than the dew point of the sulfuric acid. The temperature of this mixture is maintained at 220 to 260 C to produce ammonium sulfate which is 98.5 to 99.6% pure, with a crystal size of 1 to 3 microns and which is easily removed from the gas stream by cyclone, cottrell, or bag filters. Tests in a pilot plant resulted in 95% maximum sulfur recovery, with an economically feasible recovery of 70 to 80%. The net 1967 operation costs were $0.44/q of fuel oil burned and 0.09 mills/kwhr.

5140 APTIC NUMBER 14419

Kiyoura Raisaku, Toshio Yoshida, Haruo Kuronuma, and Gisuke Uwanishi
STUDIES OF SULFUR DIOXIDE REMOVAL FROM HOT STACK GASES. PART II. (Untersuchungen ueber die Abscheidung von Schwefeldioxid aus heissen Abgasen. - 2. Teil). Text in German. Bull. Tokyo Inst. Technol., no. 98:39-45, 1969. 10 refs.

The operation of a Kiyoura-T.I.T. process pilot plant is discussed. The Kiyoura-T.I.T. Process consists of the catalytic oxidation of sulfur dioxide to SO3 by vanadium pentoxide with the subsequent addition of ammonia. The sulfur trioxide reacts with the ammonia to form ammonium sulfate, which is separated in an electrostatic precipitator. Since January 1967, a pilot plant for 500 cu m/hr has been in operation, cleaning the waste gases from a boiler furnace fired with heavy fuel oil containing 3.6% sulfur. Prior to desulfurization of the waste gas, the dust is separated in two filters with ceramic pellets. The dust-free waste gas is then passed over 167 cu dm vanadium pentoxide in three layers. The reaction temperature lies between 420 and 450 C, the pressure drop is 50 mm water, and with a residence time of 1.2 sec, a reaction efficiency of 91 to 93% is achieved. The gas coming from the reactor is cooled to 240 C for mixing with ammonia in a 1:2 ratio. The gas is further cooled to 140 C, and 99.2-99.6% pure ammonium sulfate precipitates. The collection efficiency of the electrostatic precipitator is 97.5 C.

5141 APTIC NUMBER 14438

Kiyoura, Raisaku, Toshio Yoshida, Haruo Kuronuma, and Gisuke Uwanishi
STUDY OF SULFUR DIOXIDE REMOVAL FROM HOT FLUE GASES. (Untersuchungen ueber das Ausscheiden von Schwefeldioxid aus heissen Rauchgasen). Text in German. Bull. Tokyo Inst. Technol., no. 98:35-38, 1969. 2 refs.

The Kiyoura-T.I.T. process for the removal of sulfur dioxide from flue gases makes use of the oxidation of SO2 to SO3 in the presence of vanadium pentoxide at a temperature between 380 and 450 C. It is similar to the Monsanto-Penelec process. A limited quantity of water vapor contained in the flue gas reacts with SO2 to form sulfuric acid. Ammonia is added at a temperature not below the dew point of sulfuric acid. To obtain pure ammonium sulfate, the temperature of the gas mixture must lie between 220 and 260 C. This temperature prevents formation of acid ammonium sulfate, amides, and imides and prevents corrosion. Finally, it helps to form adequate ammonium sulfate particle sizes for precipitation in electrostatic precipitators, cyclones, or in filters. Ammonium sulfate crystals are considerably simpler to precipitate than H2SO4. The precipitated material can be used directly as fertilizer. The process was tested in the laboratory and in a pilot model. The space velocity on the catalyst was 3000 to 7000 per hour; 95% of the SO2 was removed. The crystal size of the ammonium sulfate was between 1 and 3 microns, and the purity of the product was between 98.5 and 99.6%. Estimated operating costs of the process are quoted.

5142 APTIC NUMBER 14932

AGREEMENT BETWEEN FUJI CITY AND DAISHOWA PAPER MANUFACTURING CO. IN RELATION TO THE PREVENTION OF EXISTING PUBLIC NUISANCE. (Fujishi oyobi Daishowa seishi kabushikigaisha no kisonkogai no boshi ni kansuru kyoteisho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):475-478, June 1969.

An agreement between the city of Fuji and the Daishowa Paper Mfg. Co. with respect to environment sanitation and protection of the local residents from industrial pollution is presented. The eight items of the agreement were: (I) The company is to install air pollution control facilities before the prescribed date. (II) The company will follow the occasional recommendations made by Fuji City when the need arises. (III) The company should obtain approval from the city for alteration of the conditions specified in any articles in the agreement. (IV) Fuji City is allowed to request data on the air pollution control installations from the company and is permitted to inspect the inside of the plant. (V) If any detrimental effects are felt by the local residents in spite of the existing agreement, the company should promptly take countermeasures. (VI) The company is encouraged to cooperate in beautifying the area surrounding the plant. (VII) The company is required to take prompt action if any damage to community buildings occurs. (VIII) Both Fuji City and the company are responsible for anything not mentioned above. Existing pollution control plans include decreasing SO2 emissions; alkaline mist diffusion control; noise and odor control; and waste water pollution control. The city is responsible for keeping the emission standard constant, and the company will keep alkaline emissions to 0.075 g/N cu m.

5143 APTIC NUMBER 14929

Kondo, Hachiro and Takesi Yoneda
DUST AND SMOKE CONTROL OF ELECTRIC FURNACE FOR FERRO-ALLOY. (Feroaroidenkiro haigasushujin no jisshirei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):433-440, June 1969.

The design and performance of dust collectors installed at a chemical and an electricity plant are described. The collectors were designed to process 152,000 N cu m/hr of gas for a 16,000 kva furnace and 50,000 N cu m/hr for a 4500 kva furnace. Gas temperature was maintained below 130 C, particle size was extremely small (0.3-0.9 micron), and particles were electrically charged. Open-type teflon bag filters were installed

with blowers. Collected dust was removed from the filter in 3 min by joint operation of horizontal and vertical vibrators. Care was taken to prevent the filter from becoming electrostatically charged. Filtration speeds of 0.7 m/min for teflon filters and 0.6 m/min for fiberglass filters were designed to keep the pressure loss below 200 mm Hg. Among the yet unsolved problems are the design of a furnace cover to reduce the amount of gas it is necessary to process; a method of cooling the gas; a method for preventing electrostatic charge on the particles; a means of utilizing the recovered dust; means for prolonging the life of fiberglass filters; and simplification of waste water processing from wet-type dust collectors.

5144 APTIC NUMBER 15670

Krijgsman M.
RECOVERY AND UTILIZATION OF DUST FROM THE BASIC OXYGEN STEELMAKING PROCESS. Blast Furn. Steel Plant, 54(4), p. 48, 46, 50, 58, 58, 62, 108, April 1966.

The oxygen process for producing steel from liquid pig iron and scrap forms volatile iron compounds that escape with the flue gas as a very fine dust. The dust is a valuable raw material since it consists of iron oxide and lime with few impurities. At a blast furnace and steelworks in The Netherlands, basic oxygen steel is produced with three converters of 100 metric tons capacity each. The flue gases are cleaned in a spray cooler and subsequently in a venturi scrubber down to approximately 1% of the original dust content. Coarse particles of dust are precipitated in the spray cooler, fine particles in the venturi scrubber. The water from the spray tower is passed to a hydrocyclone where particles over 100 mesh are dewatered to a moisture content of 25%. The overflow of the hydrocylone is then fed to a thickener along with the effluent from the venturi. The resulting mud of the thickener is dewatered with a rotating vacuum filter and the moist residues processed in a helical plugging mill. By adding lime to the residues, a valuable raw material for sintering is obtained: it can be added to a mixture of fine ores at any proportion. The economy of the process depends on the size of the plant required and on the current price of fine ores. In Western Europe costs can be recovered within a few years.

5145 APTIC NUMBER 14978

Kruel, M. and H. Juntgen
REACTOR OF DOLOMITE AND OTHER ALKALINE-EARTH COMPOUNDS IN A DUST CLOUD WITH SO2 IN FLUE GASES. (Reaktion von Dolomitkalk und anderen Erdalkali-Verbindungen mit den SO2 Rauchgase in einer Flugstaubwolke). Text in German. Chem. Ing. Tech., 39(9-10):607-613, Jan. 1967. 7 refs.

A pilot plant was constructed to study the desulfurization of flue gases by introduction of a cloud of dolomite dust. Hot flue gases were passed through a reactor tube, which could be heated to 400-900 C, and simultaneously desulfurized dust composed of CaO, MgO (CaO), and CaCO3 was blown into the reactor. Samples were taken during the reaction at sampling points along the reactor to investigate the mechanism of desulfurization in the dust cloud. The desulfurizing effect depends mainly on the temperature, the stoichiometric quotient desulfurizer/SO2, as well as on the particle size and the chemical composition of the desulfurizer. The residence time of a desulfurizer particle in the hot flue gases is of only secondary importance as long as a minimum time of 1.5 sec is exceeded. (Author abstract modified)

5146 APTIC NUMBER 14728

Krynitsky, John A.
MILITARY PROCUREMENT PROBLEMS RESULTING FROM AIR POLLUTION CONTROLS. Preprint, National Petroleum Refiners Association, Washington, D. C., 11p., 1968. (Presented at the National Fuels and Lubricants Meeting, New York, N. Y., Sept. 11-12, 1968, PRL-68-61.)

The efforts of the Department of Defense (DoD) to comply with Federal and local air pollution control regulations are coordinated by its Environmental Pollution Control Committee, established in January, 1966. As an example of these efforts, to comply with Rule 66 of the Los Angeles Air Pollution Control District which severly restricts the emission of organic materials to the atmosphere and involves many paints and cleaners used by DOD installations and contractors, substitute fluids and solvents are being sought and catalytic incinerators for destroying the vapors are being employed. A time-phased 5-year program for compliance is now in effect. The Department, which may be the biggest buyer of heating oil in the world, is also greatly affected by standards for Federal facilities limiting the emission of pollutants from the burning of fossil fuels. These include limits on particulate emissions, on the visual density of smoke, on vapor losses from gasoline and other volatile organic materials, and on sulfur oxide emissions. Efforts are being concentrated on obtaining adequate supplies of low sulfur heavier burner fuel oils. DOD has adopted a policy of converting to fuel of 1% sulfur content as soon as practical in order to comply with or surpass all local regulations and provide leadership in pollution control. A program to monitor the quality of fuels being received from suppliers is in operation. Five-year plans covering 313 military installations in the three service branches have been drawn up for the phased and orderly correction of air pollution deficiencies, and are now under review.

5147 APTIC NUMBER 14842

Kuhlmann, A.
TOWNS AND COMMUNITIES CANNOT IGNORE THE NECESSITY OF RUBBISH INCINERATION. (Staedte und Gemeinden duerfen sich der Notwendigkeit zur Muellverbrennung nicht entziehen.) Text in German. Brennstoff-Waerme-Kraft, 20(9):405-408. Sept. 1968.

From the point of view of hygiene, the use of dumps is indefensible, while rubbish incineration using modern techniques is both satisfactory and economically feasible. Graphs showing the annual total weight and volume of rubbish produced per inhabitant in the cities of Amsterdam, Stockholm, West Berlin,

Dusseldorf, Hamburg, Hannover and Frankfurt am Main are given. As an example, a graph showing the heating values of rubbish in the years 1955 to 1968 Bern, Switzerland exhibits a strongly rising trend. The present state of rubbish combustion is discussed. The initial and operating costs are considered in detail and a numerical example of the rubbish combustion plant costs for a city of 850,000 inhabitants is given.

5148 APTIC NUMBER 18982

Furamochi, Kazuo
EXPERIMENTAL RESEARCH TO IMPROVE EFFICIENCY OF AN AIR FILTER INSTALLED IN THE TORANOMON HOSPITAL. (Fa firuta secchi rei). Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 7(1):51-58, April 1969.

The filter used at the Toranomon hospital has the defect of acquiring dust, although the multi-panel system is otherwise economical and efficient. Since it was important that the operating room be completely sterile, an electronic high-efficiency air filter was additionally installed. It was found that the problem of dust accumulation was due to dust not being absorbed sufficiently by the filters. A glass wool pre-filter was designed to solve the problem; the material was later changed to a synthetic fiber for ease of cleaning and durability. Further testing remains to be carried out to find a solution to the problem of dust accumulation.

5149 APTIC NUMBER 18671

Formeier, Hans H.
REMOVAL AND DEODORIZING OF GASEOUS EMISSIONS FROM FISH MEAL AND OTHER FACTORIES. (Die Beseitigung und Desodorierung gasformiger Emissionen von Fischmehlfabriken und anderen Betrieben). Text in German. Wasser Luft Betrieb, 5(1):7-10, Jan. 1961. 1 ref.

The development of a new deodorizing process for emissions from fish meal plants is described. There are two types of emissions in the fish meal industry, namely, those from steam driers and those from air lift driers. The former are alkaline waste gases composed mainly of water, odorous bases, and carbon dioxide. Waste gases from air lift dries are acidic and contain water, and sulfur dioxide. By scrubbing the waste gases from the air lift drier with water, almost all odorous bases bound to SO2 could be removed. Experiments showed that the remaining odors disappeared when the waste gas was passed over CaCO3 in the presence of SO2. By raising the pH, the odorous compounds were liberated and the fishy odor returned. Thus it is seen that the odors are chemically bound to CaCO3. Based on this finding, a scrubbing tower was constructed filled with limestone to a height of 600 cm and wood which is constantly sprayed with water. The gases from the air lift drier after passing through the scrubber had a slightly bluish color but no odor. The waste scrubbing water contained 11.8% SO2 at a pH of 6.1 compared to pH 6.85 in the entering water. Drum driers are likewise discussed briefly for comparison, although they are only used today in Japan.

5150 APTIC NUMBER 15090

Landeborg, Lars Erik, Sune Torsten Henriksson, and Ragnar Ludvig Nuotka
METHOD AND A DEVICE FOR PURIFYING THE EXHAUST GASES FROM MOTOR-DRIVEN MINING TRUCKS. (Assignee not given.) U. S. Pat. 3,466,093. 8p., Sept. 9, 1969. 6 refs. (Appl. May 18, 1967, 10 claims).

A method is described for purifying exhaust gases from truck engines used to transport ores and rocks in mines or other places difficult to ventilate. The method entails passing the exhaust gases to openings near or at the bottom of the load container of the trucks and forcing the gases to rise through the ore carried in the container. The ore acts as a filter medium and cooling magazine by means of which steam is condensed to soot and oil particles are deposited on the ore. Equipment for accomplishing the method includes a duct system in the load container and an articulated pipeline for connecting the exhaust outlet to the duct system. The pipeline has a spherical joint at both ends, one restrained for upward swinging of the pipe section, and the other constructed to be automatically disengaged on pivoting of the load container. A verticle rotatable coupling positioned between the engine exhaust and the second joint permits the pipeline to be rotated about a vertically extending axis. The invention is designed to operate only while trucks are carrying ore from the place of loading to the place of dumping.

5151 APTIC NUMBER 14469

Lauer, Karl-Heinz
EXPERIMENTS ON THE DESULFURIZATION OF LOW-SULFUR GASOLINES. (Versuche zur Entschwefelung von Benzinen mit geringem Schwefelgehalt). Text in German. Gas Erdgas (Munich), 110(19):516-520, March 1969. 2 refs.

For the study of low-sulfur gasoline desulfurization, a scaled-down apparatus was used which was flushed with nitrogen prior to the beginning of each experiment. Gasoline was mixed with reducing gas, evaporated, and heated to 350 C. The pressure in all experiments was 20 ats. The hydrogenation reactor contained 2.5 l catalyst, and it was heated from the outside to compensate for the heat loss. The subsequent Lux mass (catalyst) reactor was likewise heated. Between the two reactors was a control valve so that the test material could be studied either after the hydrogenation reactor or after the Lux mass reactor. Gas chromatography was used for the analysis. The hydrogenation contact consisted of 10% Ni and 3% Mo on an aluminum oxide base. The Lux mass contained 47.3% Fe2O3. A total of four tests were performed, each lasting 90 hrs. The first two experiments were conducted with a large-sized Lux mass absorber and the last two with a small sized absorber. In the second and fourth tests, a mixture of hydrogen, CO (6% by volume), and CO2 (5% by volume) was used instead of hydrogen alone. The results show that after the hydrogenation stage, methane is formed particularly with carbon monoxide-containing gases. This reaction is continued in the Lux mass. In all experiments, good desulfurization of the gasoline was achieved. A discussion of the paper is included.

5152 APTIC NUMBER 15359

Le Page, Madeleine, Raymond Beau, and Jacques Duchene
POROUS BODIES CONSISTING OF AT LEAST PARTIALLY CRYSTALLIZED SILICA. (Corps poreux constitues de silice au moins partiellement cristallisee). Text in French. (Produits Chimiques Pechiney-Saint-Gobain) French Pat. 1,482,867. 8p., June 2, 1967. (Appl. Jan. 31, 1966, 3 claims).

The invention concerns porous bodies consisting of at least partly crystallized silica, their applications, particularly in adsorption and in catalysis, and the procedure for their production. Grains of silica gel containing a certain amount (between 1 and 10 weight %) of alkaline metal atoms in the form of Na2O are calcined at a temperature of 800 to 1200 C. The silica gel grains may be obtained either by coagulation of droplets of silica sol in a water insoluble liquid in the form of spherules, or by pulverization of silica gel obtained in bulk, or by reacting an alkali metal silicate with an acid. In examples illustrating the production and some properties of the porous bodies, the silica sol is obtained by letting an aqueous solution of sodium silicate react with sulfuric acid mixed in different proportions and yielding different contents of 'free' Na2O in the resulting silica sol. These silica bodies have a surface area varying between 1 sq m/g and several dozen sq m/g with well-defined pore dimensions which may be adjusted between several dozen angstroms to around 10,000 A.

5153 APTIC NUMBER 18387

Lee, G. and D. J. Lewis
ACCEPTANCE TESTS OF GAS SCRUBBER INSTALLATIONS, WOOMERA. Weapons Research Establishment, Salisbury, S. Australia, Dept. of Supply, TN DWD 6, 60p., July 1968. 11 refs.
CFSTI: N69-27608

The results of tests carried out to determine the flow characteristics of the gas scrubber systems installed at Launcher 6A, Woomera are reported. From the series of flow rate/pressure drop tests carried out in piping and scrubber systems, 'K' factors were derived, expressing the characteristics of the system in terms of average pressure, pressure drop, and flow rate. These K values are used to determine the characteristics of a vent system operating at certain flow and pressure conditions. The results demonstrate that the stage-2 tower and mast vent systems meet performance requirements. Another series of tests show that the stage-1 vent system (umbilical mast) comply with the requirements for normal venting, but it should be noted that if emergency venting of the helium supply is to be considered, further testing of this aspect should be carried out. If the K factor of a system is known, the pressure difference may be calculated from a knowledge of the flow rate. In a series of tests, consistent K values for the stage-2 piping system were found. For the stage-2 mast system vent, the values of K in relation to the flow rate show that the effect of the nozzle is pronounced.

5154 APTIC NUMBER 18975

Lee, R. C. and D. R. Wisner
EXHAUST EMISSION ABATEMENT BY FUEL VARIATIONS TO PRODUCE LEAN COMBUSTION. Preprint, Society of Automotive Engineers, Inc., New York, 20p., 1968. 15 refs. (Presented at the National Fuels and Lubricants Meeting, Tulsa, Okla., Oct. 29-31, 1968, Paper 680769.)

Differences in the power producing capacities and exhaust emission characteristics of various spark-ignition-engine fuels are frequently obscured by interactions involving the particular engine system used in the comparison. In an attempt to minimize this problem, gasoline, propane, methane, and a hydrogen-methane fuel gas were compared in a single cylinder engine under conditions that were optimum for each fuel. The resulting data, coupled with an estimated duty cycle representative of traffic service, permitted the development of internally comparable data on fuel consumption and exhaust emissions. Smog-inducing hydrocarbon emissions from the exhaust of a propane-fueled engine can be less than 13% of the minimum value obtainable with a gasoline fueled engine. Such emissions would be substantially eliminated with a well designed methane engine. Engines designed for propane and methane should have substantially no carbon monoxide in the exhaust, and only 40-50% as much nitric oxide as an engine designed for gasoline. In addition, lower specific fuel consumptions are possible with propane and methane. These benefits are primarily the result of better lean combustion performance with the two gaseous fuels. It is recognized that a fuel gas that might be steam-reformed from a liquid fuel would have even better lean mixture combustion behaviour and lower emissions than propane or methane. (Author abstract modified)

5155 APTIC NUMBER 13871

Lessing, Rudolf
IMPROVEMENTS IN AND RELATING TO THE PURIFICATION OF COMBUSTION GASES AND APPARATUS THEREFOR. (Assignee not given) Brit. Pat. 416,671. 8p., Sept. 17, 1934. (Appl. March 17, 1933, 11 claims).

A process and apparatus for removing sulfur oxides from combustion gases are described. The flue gases to be cleaned pass into a gas washing tower, after which they are allowed to escape into the atmosphere. The washing liquor, which may be a suspension of calcium hydroxide or carbonate, collects in the bottom of the tower and is delivered to an oxidizer. Calcium sulfite, which is formed when the washing liquor is brought into contact with the combustion gases, is converted to calcium sulfate in the oxidizer. From here the washing liquor passes to a mixing vessel where it is mixed with chalk. Calcium sulfate in the washing medium has a tendency to adhere to the surfaces with which it is in contact. To counteract this tendency, the surfaces are periodically flushed with an aqueous washing liquor which is free from calcium sulfate.

5156 APTIC NUMBER 15364

PROCEDURE FOR PURIFICATION OF WASTE WATER CONTAINING HYDROGEN SULFIDE AND CARBON DISULFIDE. (Procede d'epuration d'eaux residuaires contenant du sulfure d'hydrogene et du sulfure de carbone). Text in French. (Licentia Patent-Verwaltungs-G.m.b.H.) French Pat. 861,191. 3p., Feb. 3, 1941. (Appl. July 20, 1939, 1 claim).

Hydrogen sulfide and carbon disulfide driven off by any known procedure from waste water of the rayon industry can be burned in a gas burner with an air excess in such a manner as to yield sulfur dioxide, which is bound in an aqueous Na2CO3 solution as NaHSO3.

5157 APTIC NUMBER 15366

PROCEDURE FOR SEPARATION OF SULFUR DIOXIDE CONTAINED IN GASES. (Procede de separation de l'anhydride sulfureux contenu dans des gaz). Text in French. (London Power Co., Ltd., England) French Pat. 738,307. 4p., Dec. 23, 1932. (Appl. June 8, 1932, 2 claims).

The invention concerns a procedure for elimination of SO2 from gases, notably flue gases, by means of an aqueous liquor containing an oxidizing catalyst in solution or in suspension. The sulfur compounds are preferably eliminated in the form of CaSO4, and the used liquor is regenerated while in circulation so that it is reused in a closed circuit. Some lime is added to the liquor at certain stages of the cycle to precipitate and thus remove the CaSO4. The gases are treated with an alkaline suspension of Fe(OH)2, the alkalinity of the liquor being maintained by additions of lime or any other alkali. The gases are treated first with a liquor formed by an acid solution of FeSO4 and then with a separately introduced alkaline suspension of Fe(OH)2. The CaSO4 is removed from the liquor while it is still acidic in order to avoid a loss of the catalyst, and the neutralizing agent is then added to a part or the whole of the liquor before it reacts again with the gases. Soluble salts are extracted from the liquor by separating the catalyst and the CaSO4 from one part of the still alkaline solution. The residual liquid containing the dissolved salts is extracted, and the precipitates are returned to circulation. The oxidation of SO2 takes place after the liquor has left the absorption chamber and sufficient time has been allowed to elapse before removal of the CaSO4.

5158 APTIC NUMBER 14336

Ludwig, John H.
AIR POLLUTION CONTROL AND THE ROLE OF HETEROGENEOUS CATALYSIS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 25-29.

The Air Quality Control Act and the role of catalysis are discussed. The Air Quality Act is a blueprint for attacking air pollution through the adoption and implementation of air quality standards on a regional basis, through continued national regulation of motor vehicle pollution, and through accelerated research and development. In all of the expanding activity, efforts are directed toward the development of effective devices for use against pollutants and toward the continued improvement or cost reduction of control processes which are now employed. Catalysis plays an increasingly important role in more sophisticated areas of air pollution control. The potential of heterogeneous catalysts is not fully known, but application is envisioned in areas such as odors, solvent control, motor vehicle exhaust control, electrochemical power sources, control of specific pollutants such as sulfur and nitrogen oxides, and in the entire area of improved instrumentation.

5159 APTIC NUMBER 15343

Lumiaro, Pentti
THE TECHNICAL PRINCIPLE OF OPERATION OF EXHAUST GAS PURIFIERS. (Pakokaasunpuhdistimien teknillinen toimintatapa). Text in Finnish. Teknillinen Aikakauslehti, no. 4:71-73, April 1969.

The main principle of exhaust purification for internal combustion engines is as complete a combustion as possible. About 20-30% of the hydrocarbons reaching the tailpipe are derived from crankcase ventilation. The air injection reactor (AIR) system used by three large U. S. automobile manufacturers offers no advantages in terms of fuel consumption and slightly decreases the net capacity of the motor. The controlled combustion system (CCS) used by General Motors preheats the air arriving at the cylinder intake while the motor is warming up or during idling or low-speed operation. Volvo passenger cars make use of twin carburetors in conjunction with CCS, which offers the advantage of a slight fuel economy. The Chrysler Motors cleaner air package (CAP) makes use of a special vacuum valve used in conjunction with new types of carburetor, distributor, and gear box. This valve interprets motor speed and load in such a way as to control the timing of ignition in the distribution. Use of transistorized ignition systems has been abandoned as impractical, but thyristorized ignition has been successfully tested on numerous vehicles. Since the lifetime of motor vehicles in Finland is about 9 years, there are many American vehicles lacking exhaust purification, whereas Volvo cars always have had exhaust purifiers as standard equipment. Exhaust purification laws would thus tend to favor Scandinavian industry. The argument that domestic manufacturing of autos would help combat pollution seems absurd when Finnish manufacturers are constantly marketing motorized appliances that foster pollution and have been banned in Sweden for this reason.

5160 APTIC NUMBER 14341

Lunche, Robert G.
FUME AND ODOR DESTRUCTION BY CATALYTIC AFTERBURNERS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and

Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 297-320. 6 refs.

The operating and design aspects of the catalytic afterburning process are reviewed, and its application and effectiveness are discussed on the basis of the experience of the Los Angeles County Air Pollution Control District in testing a wide variety of catalytic afterburners in industrial use. Because of certain operating characteristics of these afterburners, they represent a partial oxidation process which produces compounds in the treated effluents that are often more offensive and odorous than the original fumes and odors. Investigations by the District show that partial oxidation produces olefinic and other oxidation products that often increase the eye-irritating, photochemical smog-forming potential of treated effluents to levels greater than those of the original fumes and odors. In general, an afterburner must oxidize 90% or more of the carbon in the entering materials to CO_2 to be judged effective. On the basis of the District's own experience and reports of others, the actual performance of catalytic afterburners for reducing many fumes and odors is considered inadequate. Without an advance in performance, it does not seem likely that catalytic afterburners will be able to comply with Los Angeles County's organic emissions standards unless the operating temperatures are at a level that renders the catalyst unnecessary.

5161 APTIC NUMBER 15164

Maassen, Alovs
GAS HEAT - A PRACTICAL SOLUTION AGAINST AIR POLLUTION - EXEMPLARY RESIDENTIAL AREAS. (Gaswaerme - ein praktisches Mittel der Lufthygiene - Beispielgebende Grossiedlungen). Text in German. Staedtehygiene (Velzen/Hamburg), 20(10):249-252, 1969.

Several examples of residential areas heated by gas are given, and the importance of gas heating in preventing pollution is stressed. In a residential area of Hanover consisting of one-family houses and apartments, decentralized gas-heating systems were installed in accordance with the health department's call for cleaner air. In either houses or apartments the individual systems cater to the requirements of the individual family. In Hamburg, a residential area with 3000 apartments which is still in the construction stage will be heated from several gas heat supply stations. One such station will supply 30 to 40 apartments. A warm-water central heating system was planned for a projected residental area in Coblenz with 850 apartments until feasibility studies showed gas or oil heat to be preferable. Since stacks required for oil heating would have been too high, gas heating systems are being adopted.

5162 APTIC NUMBER 15853

AUTOMATED LINE FOR THE PRODUCTION OF EXTRUDED AIR ROTORS. Mach. Prod. Mng., 113(2917):748-752, Oct. 9, 1968.

The General Motors air injector reactor, used with high-performance automobile engines and in cars equipped with manual transmissions, controls the exhaust emission of hydrocarbons and carbon monoxide. Fresh air is injected into the engine exhaust ports to produce a higher degree of afterburning and to ensure that the final exhaust gas composition is acceptable. Supplementary air is supplied by pumps. Possible methods were studied for mass production of the air pumps at the rate of 13,000 per day. Raw material and machining requirements were reduced and stronger parts obtained when the air pump rotors were cold extruded: the slug is sheared from a bar, coined, extruded, and restruck. Slug shearing is carried out on a Verson 250-ton press operating at 60 strokes per minute. Sheared slugs are rolled down a discharge chute to a conveyor which delivers them to an automatic weighing and segregating unit. Acceptable slugs drop into one chute; overweight and underweight slugs slide down separate chutes. Upsetting of the sheared slugs is performed on a Bliss 800-ton knuckle-joint press. Upset slugs are washed and receive a normalizing annealing treatment to produce a uniform structure and a hardness of 45 to 50 Rockwell B. Prior to extrusion, the slugs are cleaned, phosphate coated, and lubricated. Extrusion of the rotors is carried out on a Clearing 1500-ton, eccentric, gear-driven mechanical press. Final forming of the closed bottoms of the rotors is carried out by a restrike operation performed on a Bliss 1500-ton knuckle joint press. Piercing of slots in the rotors and formation of notches to serve as chipbreakers during subsequent machining are performed on a Danly 100-ton press. External surfaces are finished on Landis plunge grinding machines; bores are finished on Bryant Centalign internal grinding machines. Air sealing between the high and low pressure areas of the pumps is provided by spraying exterior surfaces of the rotors with an abradable coating.

5163 APTIC NUMBER 13785

Mactaggart, T. F.
SULPHUR RECOVERY FROM STACK GASES. Ind. Chemist, 16:341-344, Dec. 1940. 19 refs.

The methods used by four gas-cleaning systems for recovering sulfur in the form of sulfur dioxide are summarized and evaluated. The systems are the I. C. I., Guggenheim, Johnstone and Singh, and the Trail smelter processes. At the Imatra smelter plant, where the I. C. I. process is used, the absorbent is basic aluminum sulfate. An amount of sulfur dioxide is oxidized to sulfate and has to be removed from the system to prevent a decrease in the buffer effect of the solution. Removal is effected by the addition of limestone slurry, followed by filtration and the removal of sulfate as gypsum. The Guggenheim process uses ammonia sulfite as the absorbing medium. Ammonium bisulfite is formed first, and when the liquor is heated, sulfur dioxide is evolved. The difficulty is that part of the sulfur dioxide is oxidized and the ammonium sulfate formed has to be filtered off in the form of crystals and the ammonia regenerated by lime. Both process require an excessive amount of heat. By substituting chemical means of regeneration for heat, the Guggenheim process makes rapid recovery possible. The process uses sodium sulfite solution and zinc oxide. Although flotation methods used in the Trail smelter process remove much sulfur from zinc, iron, and lead sulfite ores as iron sulfide, smelting

yields gases containing up to 8% sulfur dioxide. To prevent this from escaping into the atmosphere, end gases are treated by passing them through Lodge-Cottrell precipitators, washing and cooling them with water, and circulating them in wooden absorption towers. At Trail, sulfur dioxide can also be converted into elemental sulfur by passing the gas through special coke furnaces.

5164 APTIC NUMBER -----

Wacie, W. A.
IMPACT OF AIR POLLUTION REGULATIONS ON WEB OFFSET PRINTING.
Am. Ink Maker, 46(12):22-23, 67-68, Dec. 1968.

Hydrocarbons are the chief pollutants emitted from printing companies which use web offset presses. A simple 600 F afterburner will eliminate the blue smoke (formed by hydrocarbons reacting with sunlight) from the average exhaust stack, but complete combustion is necessary to eliminate odor and takes place at 1200 F with thermal incineration or 900 F with a catalyst. Proper maintenance also aids in reducing the emissions. Tests have shown that the amount of solvent or oil in the exhaust gases of dryers is 10 times higher than normal if the paper is overheated.

5165 APTIC NUMBER 15157

Maher, Joseph I.
METHOD AND MEANS FOR DISPOSAL OF WASTE GAS. (Crest Engineering, Inc., Tulsa, Okla.) U. S. Pat. 3,468,238. 6p., Sept. 23, 1969. 2 refs. (Appl. Oct. 19, 1967, 5 claims).

A method is described for dispersing waste gas from petroleum production. A vertical stack is employed in which a fan rotates in a horizontal plane at the lower end. Gas is diverted from a vertical discharge beneath the fan in the direction of fan rotation. A manifold conduit and branch conduits which extend upward from the manifold to a horizontal plane bring waste gas beneath the fan. Diverters mounted on the ends of the branch conduits direct the gas in the direction of the fan rotation. The result is a swirling of the gas streams which initiates mixing of the gas and air flowing up to the fan. This also reduces the force of gas impingement on the fan. A valve structure over the discharge end of each branch conduit controls the amount of the total gas discharged from each branch. The quantity of gas discharged can be varied to obtain a uniform distribution over the cross section of the stack. The device is particularly adapted for use in off-shore drilling installations.

5166 APTIC NUMBER 15767

Maher, Joseph I.
METHOD AND MEANS FOR DISPOSAL OF WASTE GAS. (Crest Engineering, Inc., Tulsa, Okla.) U. S. Pat. 3,468,238. 7p., Sept. 23, 1969. 2 refs. (Appl. Oct. 19, 1967, 5 claims).

A method and a dispersal unit are described for achieving controlled, uniform dispersion of large quantities of waste gas from petroleum production, particularly off-shore production. The unit includes a vertical stack with a fan mounted at its lower end and a manifold conduit which brings gas beneath the fan. Diverters mounted on branch conduits direct the gas in the direction of fan rotation. The result is a swirling of the gas stream beneath the fan which initiates mixing the gas and air flowing up to the fan. Valve means are provided to control the amount of gas discharged from each branch conduit. By releasing the gas in predetermined quantities, a uniform distribution is obtained over the cross section of the stack.

5167 APTIC NUMBER 13730

Makino, Kazutaka and Koichi Yinoya
COLLECTION EFFICIENCY OF A SINGLE FIBER OF ELECTRICALLY CONDUCTIVE FIBROUS FILTER. (Doden seniso fuiruta no tanitsu seni hoshu koritsu). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 33(7):701-702, July 1969. 5 refs.

The high collection efficiency of a dielectric fibrous filter with high electric voltage is contrasted with that of a nonelectric fibrous filter. The dielectric filter retains bipolar cylinders and bipolar particles within a strong electric field, and air passes vertically through the filter. Although the incremental ratio of collection efficiency of single dielectric fiber decreases as the volume fraction of a fiber increases, the ratio is 30 times as high as the ratio exhibited by a nonelectric single fiber. In addition, the dielectric filter can compensate for the decrease of collection efficiency caused by the interference mechanism of the filter. The increment of collection efficiency of a single fiber can be calculated.

5168 APTIC NUMBER 15766

Markant, Henry P., Norman D. Phillips, and Indravadan S. Shah
SYSTEM FOR ABSORBING H2S GASES. (Babcock & Wilcox Co., New York) U. S. Pat. 3,471,289. 4p., Oct. 7, 1969. 7 refs. (Appl. Feb. 2, 1965, 6 claims).

In the sulfate, or Kraft, process for producing paper pulp, hydrogen sulfide is released by the hot combustion gases used to concentrate partially concentrated liquor prior to its incineration. Its removal is desirable to minimize air pollution, but known absorption systems have been applicable only to high concentrations and have required the use of commercially prepared absorbing solutions. In the present invention, it is shown that less than 1% hydrogen sulfide and carbon dioxide can be absorbed by the green liquor produced by sulfate recovery processes. These liquors contain as active compounds sodium sulfide, sodium hydroxide, and sodium carbonate. In the absorption process, precooled gases are passed through an absorption zone of a venturi-like device, in which the absorbing liquid is injected at a gas flow ratio of 6 to 10. Absorption of hydrogen sulfide by the liquid, which is recirculated, forms

sodium hydrosulfide as one stable compound. The ratio of the weight of sodium sulfite in the solution must be greater than 35; the weight ratio of hydrogen sulfide in the gas, greater than 30; and the molar concentration of sodium sulfide, greater than 0.1 times the molar concentration of sodium hydrosulfide.

5169 APTIC NUMBER 18957

Marsh, Arnold
THE REMOVAL OF SULPHUR POLLUTION. Smokeless Air (London), no. 125:202-206, 1963.

Six ways of eliminating or reducing sulfur oxide emissions are summarized. Sulfur-free sources of power include hydro and nuclear electricity, with the future possibility of power from tidal or solar energy. Sulfur-free fuels include methane and refinery gases; certain lighter oil fractions are almost sulfur-free. Much of the inorganic sulfur in coal can be removed by washing or cleaning. The removal of sulfur oxides from flue gases after combustion by wet washing is another method. Flue gases can be dispersed at such a temperature and height that by the time they reach ground level they are harmless. Sulfur-containing fuels can be burned at maximum possible efficiency so that less fuel is required and less sulfur emitted. The quantity of sulfur-coating fuels burned in an area can be regulated so that the fallout is kept below a determined level. This Maximum Allowable Concentration approach is being tried in a few countries. It is concluded that sulfur removal is not a one-solution problem and that progress can be made in many ways.

5170 APTIC NUMBER 18828

Nasa, Victor P. and George P. Gross
METHOD AND APPARATUS FOR TREATING AUTOMOTIVE EXHAUST GAS. (Esso Research and Engineering Co., Inc., Linden, N. J.) U. S. Pat. 3,460,901. 3p., Aug. 12, 1969. 6 refs. (Appl. June 11, 1965, 2 claims).

The invention provides a method for abating air pollution from automobile exhaust gas. It is concerned primarily with lowering the emission of unburned hydrocarbons and carbon monoxide by addition of an oxidation-initiating compound of hydrogen peroxide which promotes the conversion of the pollutants to innocuous CO2 and H2O. The liquid oxidant can be aspirated into exhaust gas for afterburning or injected in other ways suitable for dispersing it in carrier gas or directly in exhaust gas ports. An example of a device used for aspirating comprises a venturi scrubber and jet stream. This device can be adjusted to vary the amount of the oxidant in response to engine demand. The carrier gas in which the hydrogen peroxide-water mixture is dispersed can be air or recycled exhaust gas. By a simple valve mechanism, flow of the oxidant can be controlled and limited to periods of engine operation when unburned hydrocarbon emission tends to be highest, e.g., acceleration, deceleration, or idling. The system described can be used with both spark ignition and compression ignition engines. Further applications of the method include the treatment of exhaust gases containing lead residues or halogen compounds present in antiknock additives.

5171 APTIC NUMBER 15350

Masuda, Senichi
HUMIDITY CONTROL OF THE GAS ENTERING AN ELECTRICAL DUST COLLECTOR. (Denki shujin no iriguchi gasu choshitsu sochi). Text in Japanese. (Assignee not given.) Japanese Pat. Sho 44-12879. 1p., June 5, 1969. (Appl. Sept. 5, 1964, 3 claims).

Inside the humidity control chamber, a single plate or multiple layers of metal plates are provided around the atomized mist. A part of the introduced gas is conducted at high temperature between the metal plates and the chamber wall, thus heating up the metal plates. Even when the gas temperature drops below 100 C because of a large amount of atomization, the metal plates are kept at a temperature high enough to cause thermal repulsion of mist. Wetting of the metal plates is prevented by this provision, and the accumulation of dust is avoided. Gas temperature at an outlet is constantly monitored by a thermometer and temperature control device. The output of the control device regulates the amount of atomized water. The present invention is an improved version of the inventor's previous patent no. 39-25137.

5172 APTIC NUMBER 15623

Matsumoto, Takanobu
PRESENT STATUS OF DESULFURIZATION OF RESIDUAL OIL. (Juhyu no tetsuoka o meguru gijutsu kaihatsu to sono mondaiten). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(1):29-34, Jan. 15, 1968.

Heavy oil is desulfurized in various ways; however, the only method which has been utilized on an industrial scale is hydrogenation, classified as either indirect or direct desulfurization. Indirect desulfurization is further subdivided. Up to the present, the indirect method has been utilized. Since its desulfurization rate is low, a more effective direct method is expected to be developed. The present processes are the following: HDHPCD Isomax, CRCPDS Isomax, Gulf HDS, and H-Oil methods classified as either fixed flor and boiling floor. The H-Oil is a boiling floor method; the others are fixed floor methods. The HDHPCD Isomax method is explained as a typical example. In a crude oil containing 3.8% sulfur, 0.03% of it is contained in naphtha, and 1.0% in heavy oil. Using the H-Oil method on a crude oil containing 4.1% sulfur, naphtha contains 0.04% and heavy oil, 1.0%. The catalyst used in the above process is not reported. Commonly used catalysts are cobalt molybdenum, nickel-cobalt molybdenum on alumina substrate.

5173 APTIC NUMBER 18368

Matsumoto, K., S. Asukata, and T. Kawashima
THE PRACTICE OF REFUSE INCINERATION IN JAPAN BURNING OF REFUSE WITH HIGH MOISTURE CONTENT AND LOW CALORIFIC VALUE. American

Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 180-197. (May 5-8).

The history and development of Japanese refuse incineration facilities are presented. Numerous studies were conducted on analysis of refuse, problems of public hazards and nuisances, and theories on drying and combustion, which resulted in the formation of a Standard for Incineration Facilities in 1966. These standards have provided a stringent policy guidance for incinerator construction, as well as effective guidance to manufacturers of incinerator equipment. In 1967, a 5-year plan was undertaken to improve sanitation facilities. Processing capacity at the end of 1966 was estimated to be 27,685 tons/day. It was estimated that an additional amount to be processed during and after 1967 amounted to 33,965 tons/day. The number of cities, towns, and villages requiring refuse incineration facilities was 1273 at the beginning of the 5-year plan. Refuse in Japan has a far higher moisture content and lower calorific value (lower heating value: 500 to 1300 kcal/kg, 60 to 70% moisture content) than that of Europe or America (lower heating value: 1000-2500 kcal/kg, 10 to 45% moisture content). In the design and production of high-quality incinerators which will completely burn refuse with a high moisture content and low calorific value, the following essentials must be considered: (1) Means should be provided for effective drying of refuse; (2) the amount of fuel consumed to assist in combustion should be held to a minimum; and (3) the combustion rate should be maximized. In Japanese incinerators, refuse is dried, either by gas or air, and burned on a stoker, and the performance of this mechanism has a direct bearing upon that of the incinerator. Various types of reciprocating and traveling grate stokers are described. A typical incinerating process is detailed, together with a flow diagram of a mechanical incinerator such as is used in Japan.

5174 APTIC NUMBER 13731

Matsuno, Kazutaka and Koichi Yinoya
ESTIMATION OF COLLECTION EFFICIENCY OF A DIELECTRIC FIBROUS FILTER. (Yuden seniso fuiruta no hoshu koritsu no suitei). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 33(7):684-689, July 1969. 10 refs.

Inertia, scattering, and interference are three mechanisms affecting the collection of particles in a fibrous filter. Inertia is the dominant factor when both linear speed and diameter of particles are large; scattering is dominant when both linear speed and diameter of particles are small; and interference, which minimizes collection efficiency, is dominant when it occurs between inertia and scattering. By the use of a dielectric fibrous filter, collection efficiency is remarkably improved and interference is reduced. The dielectric fibrous filter retains both bipolar cylinders and bipolar particles within the same electric field; polluted air passes vertically through this filter. The volume fraction of fibers is less than 0.02, and there is a constant relation between the coefficient of interference and the volume fraction. Both collection efficiency of a single fiber in a dielectric fibrous filter and total collection efficiency can be calculated, and thus the collection efficiency can be controlled by changing factors in the equation. High collection efficiency is achieved with only a small loss of air pressure inside the filter.

5175 APTIC NUMBER 13728

Maura, Giancarlo
POLYAMINOALCOHOLIC RESIN AND THE ABSORPTION OF ACID GAS. (Resine poliamminoalchiloliche e adsorbimento di gas acidi). Text in Italian. Ann. Chim. (Rome), 59(7):617-623, 1969. 5 refs.

A resin capable of absorbing considerable amounts of acid gases, such as H2S and CO2, was obtained by polycondensation of tetraethylenepentamine with ethylene carbonate. The resin contains aminoalcoholic groups like the alcoholic amines employed to eliminate acid components from industrial gas mixtures. The reaction must first be carried out at temperatures below 100 C to produce, during a subsequent heating at 185 C, the formation of alcohol carbamate groups responsible for crosslinking reactions and the formation of the insoluble resin. Both end and intermediate products were characterized by I.R. spectroscopy. (Author summary modified)

5176 APTIC NUMBER 14727

McCarty, Bill
SMOG...OUR CITIES IN CRISIS. Trucking Business, 63(1):18-21, Jan. 1969.

Control devices and future designs are discussed which will reduce smog from vehicle emissions. Efforts were made by the Inter-Industry Emission Control Program to prolong the life of experimental anti-smog equipment by installing small computers under the hoods of 24 new test cars. The emission control hardware is a new type of catalytic converter. A computer control will divert exhaust fumes from around the converter under certain driving conditions to slow its deterioration. An international research program is seeking to find a combination of fuel and automotive hardware which will virtually eliminate emission as a problem. Computer systems are also used to evaluate exhaust emission content of light-duty vehicles. After the vehicle is plugged in, the system breaks down the chemical content of the exhaust fumes, and measurements are simultaneously printed on a graph and a typewriter. Research is being done on diesel smoke emissions, mainly on prolonging the life of smog devices. A turbine truck engine is to be marketed with predictions that it will emit far lower levels of objectionable exhaust emissions. Two smog-free power concepts are solar power and natural gas. A liquified natural gas (LNG)-powered automobile was tested and latest results confirm that LNG vehicles emit less than half as much smog-producing pollutants as the average for gasoline-fueled vehicles equipped with smog control devices. Carbon monoxide emissions from the LNG vehicle amounted to 0.17% at the beginning and 0.21% after 42,000 miles, as compared to 1.0% at the start and 1.2% after 42,000 miles for 1968 vehicles operating on gasoline and equipped with smog

control devices. The necessary engine modifications are relatively simple, and use of LNG as a motor fuel is suitable for truck fleet operations where vehicles are in constant operation and where there is a central location for servicing.

5177 APTIC NUMBER 15508

McCluskey, Sibley Byron
IMPROVEMENTS OF APPARATUS FOR REDUCTION OF SULFUR DIOXIDE TO ELEMENTARY SULFUR. (Perfectionnements aux appareils pour reduire de l'anhydride sulfureux en soufre elementaire). Text in French. (Assignee not given.) French Pat. 774,112. 5p., Nov. 30, 1934. (Appl. June 8, 1934, 2 claims).

The present invention concerns a device for reduction of SO2 to elementary sulfur by the use of solid carbonaceous reducing agents such as an incandescent layer of solid carbonaceous fuel in accordance with one or several of the reactions; 2SO2 + 2 C yields 2S + 2CO2; 2SO2 + 4CO yields S2 + 4CO2; 2SO2 + CH4 yields 3S2 + 4CO2 + 4H2O; and 2SO2 + 4H2 yields S2 + 4H2O. Other reactions involving other sulfur compounds, which can be used are 2SO4 + 2CS2 yields 3S2 + 2CO2; 2SO2 + 4COS yields 3S2 + 4CO2; and 2SO2 + 4H2S yields 3S2 + 4H2O. The device consists of a refractory-lined combustion chamber traversed by a moving wire mesh conveyor and resting on a steel plate enclosure whose bottom is formed of one or several hoppers for cinders and/or clinkers into which the SO2-bearing gases enter through one or several ducts, rise to pass through an incandescent layer of solid carbonaceous fuel, or its equivalent, carried by the conveyors, and escape through a refractory-lined duct located close to the first fuel-feed duct opening. The thickness of this layer is controlled by regulating the speeds of one or several mechanical feeders provided with gas-tight feed ducts through which definite amounts of new fuel can be deposited on definite sections of the conveyor at any desired instant; by regulating the speed of that conveyor; and by adjusting the height of a water-cooled refractory straight-edge for spreading the fuel on the conveyor, installed on the lower side of the refractory-lined duct near the first fuel-feed duct opening.

5178 APTIC NUMBER 18609

McLouth, R. F., H. J. Paulus, and A. J. Roberts
INCINERATION OF EPOXY GLASS LAMINATES TO RECOVER PRECIOUS METALS. American Society of Mechanical Engineers New York Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 171-175. (May 5-8).

Recovery of precious metals from electrical circuits printed on epoxy-impregnated fiberglass laminates was carried out by incineration of the scrap and rejected printed circuits at controlled temperatures, which resulted in the liberation of a considerable amount of unburned hydrocarbons and obnoxious odors into the atmosphere. The glass laminates consisted of approximately 65% fiberglass (by weight) and 35% epoxy resins. The material contained no chlorines and not more than a trace of sulfur, but 16% petra-bromo had been added to the resins to permit the use of the final product under various ambient temperatures. In addition, there was variance in type and consistency of the epoxy scrap. Based on information obtained by research on the combustion characteristics of the material, a prototype unit was constructed and tested. After successful testing of the prototype unit, a new incinerator was installed that solved the problem of hydrocarbon and odor emission. A control system was designed that should assure proper burner operation and unit temperatures and at the same time be flexible in case adjustments become necessary in the new unit. The new incinerator simplifies recovery of the precious metals due to more consistent ash quality. Polyesters and other plastics, as well as wool and vinyls have been burned in this incinerator, all with equal success.

5179 APTIC NUMBER 18757

Meites, Leonard
WEB PRINTERS AND AIR POLLUTION CONTROL. Web Printer, 1(6):1-7, 1969.

Air pollution from web printing plants consists mainly of a smoke problem, which is relatively simple to control with afterburners, and an odor problem, which presents considerable control difficulties. The most practical means of counteracting odors from paper coatings, ink solvents, improperly adjusted gas burners, and soiled papers is by either catalytic or thermal combustion. The first works best with a pure gas stream from the press dryer; in practice, however, the effluent of a press dryer may have impurities which can cause trouble with the catalyst and must therefore be considered when the system is designed. Direct flame combustion can handle impurities in the dryer effluent since its temperature range is from 1000 to 1400 F. The initial cost of a catalytic afterburner system is higher than that of a thermal system, but its operating costs are usually considered lower, although recently there has been some controversy on this point. The possibility of controlling pollution by using mild and low aromatic solvents is briefly discussed; the inks now used in web presses contain photochemically-reactant hydrocarbon solvents which violate regulations such as Rule 66 of the Los Angeles County Air Pollution Control District, and therefore require the installation of highly efficient afterburners. It is noted that the cost of air pollution control are mitigated somewhat because good afterburners reduce condensate formation on oven walls and thus increase production and improve printing quality.

5180 APTIC NUMBER 18820

Menyakin, P. S.
NOXIOUS EMISSIONS FROM PITCH COKE PLANTS. Coke Chem. (USSR) (English Transl.), no. 12:18-19, 1968.

Several steps were taken in the pitch coke plant at the Cherepovets Iron and Steel Works to prevent the discharge of steam and gases and to replace manual operations with machinery and instruments. Pitch coke oven doors were made airtight by two doors with massive flash plates riveted to their faces. A prolonged check on the performance of the doors showed them to

be fully airtight. The door lute material was changed from clay ends to a lute based on the blast furnace trough lining compound to lessen the amount of gas given off when cleaned. Machinery was modernized for mechanical cleaning. All the machinery was controlled from a cabin, thus reducing the time the operator spends in the gas-polluted zone. Waste air was directed to the raw pitch-coke gas pipe, thereby preventing carcinogenic substances from getting into the atmosphere. They are either collected in special apparatus or mixed with coke oven gas and burned in furnaces at elevated temperatures. By taking these steps, the gas emissions were greatly reduced. The jobs of workers in unhealthy sections were made easier and labor productivity rose. The number of production workers per shift was cut from 11 to 9. The two proposed methods are recommended for use in pitch coke plants at other works.

5181 APTIC NUMBER 15331

Mergenthaler, Helmut
GAS CLEANING APPARATUS. (Otto Keller, Jesingen, Wurttemberg, Germany) U. S. Pat. 3,468,109. 7p., Sept. 2, 1969. 20 refs. (Appl. May 6, 1965, 8 claims).

The present invention provides a very simple, compact, rugged, and efficient gas cleaning apparatus which can be operated without interruptions for long periods of time, in which the liquid which removes solid impurities from contaminated gases need not be circulated by pumps, and in which the liquid need not be filtered prior to entering one or more Venturis where it mixes with streams of contaminated gases. This apparatus has the same capacity as conventional gas scrubbers, while being less expensive and more reliable. A venturi-type scrubber is provided with a spray-eliminating device which removes atomized liquid and solid impurities from gas streams issuing from the scrubber outlet. The spray-eliminating device is constructed to ensure nearly complete separation of atomized liquid in a small area and in such a way that the liquid can be returned to a predetermined portion of the liquid bath without the use of filters. A stream of gas to be cleaned is fed through a nozzle into the throat of a tubular member having a diffuser extending upwardly from the throat. The nozzle defines with the throat an annular gap through which water contained in a tank surrounding the gap is sucked in and atomized so that impurities contained in the gas will adhere to the atomized liquid and will settle at the bottom of the tank. The gap is surrounded by shielding which communicates with the tank through a tube having an inlet end spaced from the bottom of the tank so that impurities settling on the tank bottom will not be recirculated through the tubular member. (Author abstract modified)

5182 APTIC NUMBER 15568

Meyers, R. A., A. Grunt, and E. Gardner
APPLICABILITY OF ORGANIC SOLIDS TO THE DEVELOPMENT OF NEW TECHNIQUES FOR REMOVING OXIDES OF SULFUR FROM FLUE GASES. (Phase II Report.) TRW Systems Group, Redondo Beach, Calif., Chemical Research and Services Dept. Contract PH 22-68-86, TRW-10669-6003-R0-00, 22p., Sept. 1, 1969.

CPSTI: PB 187 685

Selected organic solids were screened for ability to remove sulfur dioxide from synthetic flue gas and detailed data on the most promising solid were obtained. The materials were selected on the basis of known or postulated ability to take up sulfur dioxide, price and availability, thermal stability, regenerability, and mechanical properties. They included cellulosics, nigrosin, poly(N-vinylcarbazole), pyrolyzed poly(vinylchloride), and pyrolyzed poly(acrylonitrile). The specific cellulosics were waste newsprint, sawdust, and cotton. The thermal stability of the solids was determined at flue gas temperature above 215 F; their ability to take up sulfur dioxide from moving flue gas streams at 215-300 F. All the materials were thermally stable in the flue gas and all but nigrosin took up substantial amounts of sulfur dioxide. Newsprint was found to be the most promising sorbent system. Its advantages include selective and totally reversible sorption of sulfur dioxide, (low attrition), low regeneration temperatures, and the low initial price and ready availability of newsprint and low temperature regeneration. In additional studies, the rate and capacity of newsprint for SO2 sorption were determined by thermogravimetric analysis of newsprint wet increases and chemical analysis of desorption streams. It was found that newsprint picks up approximately 1-2% by weight sulfur dioxide in 20 min at a flow rate of ca 200 vol/hr. Its capacity is approximately 10% SO2 by weight. Desorption streams of 16-26% by volume sulfur dioxide are obtained at 350-450 F. (Author summary modified)

5183 APTIC NUMBER 14830

Meyers, R. A., J. L. Lewis, and J. S. Land
PHASE I REPORT. APPLICABILITY OF ORGANIC SOLIDS TO THE DEVELOPMENT OF NEW TECHNIQUES FOR REMOVING OXIDES OF SULFUR FROM FLUE GASES. TRW Inc., Redondo Beach, Calif., TRW Systems Group, Contract PH22-68-86, Report 10669 6003-R0-00, 52p., Oct. 31, 1968. 39 refs.
CPSTI: PB 185 887

A literature search was conducted to select promising organic solids for removing sulfur dioxide from flue gas, and a preliminary chemical systems analysis for candidate SO2 removal materials was performed. Organic materials were selected on the basis of ability to take up sulfur dioxide, price and availability, thermal stability, regenerability, and mechanical properties. Five organic materials were identified which offered promise for removing sulfur dioxide from flue gas. These were cellulosics, nigrosin, poly(N-vinylcarbazole), pyrolyzed poly(vinylchloride), and pyrolized poly(acrylonitrile). The specific cellulosics were waste newsprint, sawdust and cotton. The results of the preliminary chemical systems analysis demonstrate that organic solid sulfur dioxide recovery from flue gases is economically feasible where certain criteria are met. The analysis was keyed to thermal regeneration of the organic solids. However, in the case of cellulosic materials, chemical reaction and conversion of the products to useful commodities may also be a feasible process. As so little is known about the parameters involved in conversion processes at this time, a consideration of this type of regeneration was not included. (Author summary modified)

5184 APTIC NUMBER 14761

Wildh, Gosta
METHOD OF DISCHARGING DUST PRECIPITATED IN AN ELECTROSTATIC PRECIPITATOR. (Aktiebolaget Svenska Flaktfabriken, Stockholm, Sweden) U. S. Pat. 3,461,650. 3p., Aug. 19, 1969. 15 refs. (Appl. March 29, 1966, 3 claims).

Recovery of dust precipitated in an electrostatic precipitator is effected by installing a dissolving basin below the charged electrodes on which the dust falls and providing a continous supply of dissolving liquor, e.g., black liquor, to the basin. When the electrodes are cleaned, dust falling from the electrodes is dissolved in the liquid bath and transported from the precipitator to the recovery plant. The method permits the rapid admixing of dust without the formation of lumps and collection of dust in the dissolving basin and the transport pipes. It has particular applications to the recovery of dust from soda recovery boilers.

5185 APTIC NUMBER 13778

Miller, P. P.
ADSORPTION BY SILICA GEL. III. Chem. Met. Eng., 23(26):1251-1254, Dec. 29, 1920.

For continuous operation and uniform product, an adsorption system utilizing granular silica gel requires three fixed bed-type adsorbers so that a second one can be put in circuit a safe interval before the first one reaches its breaking point, while the third one is on its heating and cooling cycle. In the pulverized silica gel adsorber, the activated dust is fed into a gas stream discharging into a dust filter, adsorption taking place in the dust and filter bags. This method requires only standard equipment regularly used in metallurgical plants. Experimental plant tests using a fixed bed granular adsorber at 40 C showed the gel adsorbed 6.8% its own weight of sulfur dioxide. By heating the gel to 125 C, 90% of the adsorbed sulfur dioxide was recovered.

5186 APTIC NUMBER 15160

Minoda, Yasuharu
REVIEW ON DESULFURIZATION BY MICROORGANISMS. (Riseibutsu niyoru datsuryu no mondaiten). Text in Japanese. Nippon Kogyo Kaishi (J. Mining Met. Inst. Japan), 85(976):758-760, Aug. 1969. 18 refs.

The possibility of desulfurizing petroleum by the use of microorganisms was initially reported in 1935. Concrete methods were subsequently devised for which a patent was applied. However, the method cannot be applied to industry without modification. Since conversion of organic sulfur compounds to inorganic sulfur compounds was not demonstrated for all types of organic sulfur compounds found in petroleum, more versatile microorganisms were sought. There are many microorganisms which make hydrocarbons water-soluble by oxidation, so it was decided to look for these. Dibenzothiophenes (DBT) were chosen as model substrates, and bacteria were obtained from shake cultures. The conversion of DBT was demonstrated when samples turned red, and the conversion was verified by paper chromatography. A solution of DBT in 5-10% light oil accelerated the conversion at an optimum temperature of 28 C and neutral pH. Addition of meat extract of 0.4% also accelerated the conversion rate. Under optimum conditions, 40% of the DBT was converted to water-soluble inorganic compounds in three days. However, when the same bacteria were used in a test of crude petroleum desulfurization, the rate of conversion was extremely low. It was therefore thought that the substrate specificity of the bacteria was too great and that a more generally active bacterium was needed. It was concluded that the bacterial conversion method is still too impractical for industrial use.

5187 APTIC NUMBER 15362

PROCEDURE FOR TREATMENT OF FLUE GASES CONTAINING GASEOUS SULFUR DIOXIDE WITH RED SLURRY. (Procede de traitement des gaz de fumees contenant de l'anhydride sulfureux gazeux avec la boue rouge). Text in French. (Mitsubishi Shipbuilding and Engineering Co., Ltd., Japan) French Pat. 1,350,231. 5p., Jan. 24, 1964. (Appl. Feb. 9, 1963, 2 claims).

The invention concerns a procedure for removal of gaseous SO2 from flue gas with the aid of red slurry, which is a by-product in the production of aluminum from bauxite. The red slurry may have a composition such as: 18.9% Al2O3, 8.3% Na2O, 17.4% SiO2, 39.3% Fe2O3, 2.8% TiO2, with a combustion loss of 10.5%. The red slurry is mixed with water to obtain an aqueous suspension with not more than 40 weight % of red slurry. This suspension is brought into contact with the flue gas containing the SO2 at temperatures up to 100 C, but preferably close to ambient temperature, and the SO2 is absorbed by the sodium compounds present in the red slurry suspension to form sodium bisulfite. The latter is then separated from the insoluble residue and represents a by-product which can be industrially utilized in a variety of ways. After absorption of SO2, the pH of the aqueous suspension of red slurry should be between 3.5 and 6, and preferably close to 4.3. In cases when the SO2 content of the flue gas is low and has been adsorbed by the suspension, the latter may be made to absorb some additional SO2 gas, until its pH has been lowered to about 4.3.

5188 APTIC NUMBER 14611

Mooney, John J. and Kenneth W. Bramble
DIESEL EXHAUST PURIFICATION WITH FIXED BED CATALYSTS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Air Pollution Control, Philadelphia, Pa., Nov. 1968, p. 235-239. 2 refs.

Design considerations, field tests, and actual field experience of a new catalytic purifier for diesel exhaust gases are discussed. Based on an analysis of temperature, pressure, and available space limitations, a precious metal catalyst on a unitary ceramic support was developed as an optimum design for a diesel exhaust purifier. Many installations on diesel-powered fork lift trucks and mining machinery, monitored weekly, showed consistent oxidation of contaminants including carbon monoxide during load cycles even after 7500 hours of operation. At idle mode, where temperatures are below 200 F, odorous acroleins and aliphatic aldehydes were oxidized, whereas catalytic oxidation of carbon monoxide was no longer effected. This purifier was also evaluated on large stationary diesel-powered electric generators. For maximum advantage, the catalytic system should be considered in the initial design of the diesel engine rather than being designed as a hang-on device as it is today. It must also be recognized that for catalytic purifiers to approach maximum effectiveness, excellent engine maintenance is required to prevent discharge of smoke and oily particulate matter. Hence, the user must upgrade maintenance standards to the highest levels to alleviate many of the problems a purifier is expected to solve.

5189 APTIC NUMBER 15611

Motonaga, Hidekazu
SOME ASPECT ON DUST COLLECTION BY COMBINATION SYSTEM OF ELECTROSTATIC PRECIPITATOR AND MULTICYCLONE. (Denki shujinki oyobi maruti-saikuron no kumiawase hoshiki niyoru shujin ni tsuite no ichikosatsu). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(5):363-368, 1969. 8 refs.

The efficiencies of an electrostatic precipitator (EP) alone and various combination of the EP and the multicyclone (MC), which collects the dust from a boiler which burns powdered carbon or from a hearth which burns solid wastes, are discussed. For dust from the boiler, collection efficiencies were 89.2 to 98% using EP alone; 89.2 to 98.3% using the MC-EP combination, and 96.8 to 99% using EP-MC or MC-EP-MC (MC' is a multicyclone with higher efficiency). The latter two methods had the following advantages: collection efficiency of the EP may last longer, the power requirement of the MC and the MC' may be smaller, and the design for the complete collection system may be determined easily by measurement of dust particle diameter at the EP exit. For dust from the hearth, the efficiency of the system EP-MC was excellent because this procedure can collect about 60 to 70% of the dusts (paper flake and re-scattered dust within the EP) which are rather difficult to collect by the EP alone. The dust collecting system should be further refined according to the kinds of solid wastes.

5190 APTIC NUMBER 15087

Nucskai, Laszlo
THE PROCESS OF OXIDATION OF NITROGEN OXIDES IN THE PRESENCE OF POLYMOLECULAR NO + NO2 ABSORPTION IN THE DILUTE TAIL GASES OF NITRIC-ACID PLANTS. (Nitrogenoxid oxidacioja hig nitrozus gazokban ekvimolekularis NO + NO2 folyamatos abszorpcioja mellett). Text in Hungarian. Magy. Kem. Folyoirat, 67(11):488-490, 1961. 1 ref.

A differential equation is derived that gives the incremental change in the partial pressure of nitrogen dioxide as a function of incremental change in nitric oxide concentration, oxygen concentration, the concentration of an inert gas, and the total pressure. The above conditions refer to the tail gas of a stack at a plant where nitric acid is manufactured from nitric oxide, sodium carbonate, and water; the tail gas (NO and NO2) concentration is 0.7-1.0 vol%. Subsequently, the equation is used to derive another differential equation rendering the time needed to accomplish an incremental change in NO concentration. This latter differential equation is considerably simplified so that it can be integrated. The resulting equation is presented in the form of a nomogram that can be used to calculate the volume of the absorber column or the oxygen concentration or the time needed to perform the reaction.

5191 APTIC NUMBER 14466

Muermann, Herbert
MODERN DUST EXTRACTION EQUIPMENT. (Neuzeitliche Entstaubungsgeraete). Text in German. Wasser Luft Betrieb, 13(8):281-286, Aug. 1969.

Fine dusts developing from various polishing processes in metal finishing plants should be caught at the place of origin by exhaust fans and cleaned in subsequent dust removers. It is best to encapsulate the entire dust source and keep it at underpressure conditions. The exhaust hood should be installed as close to the source as possible. Two types of dust removal systems are commonly used in such cases. With the central dust removal system, the dust developing from various machines is drawn off by one common exhaust fan and precipitated in one common collector. The system is illustrated by the example of a vernier polishing plant for sewing machine parts. The dust developing from 20 metal polishing devices is drawn off by a high-pressure exhaust fan and the cleaned air is returned. The system operates with a collection efficiency of 99.8%. The other type of system is composed of individual exhaust fans which are capable of drawing in 5 to 75 cu m air/min. Generally, this system requires more space but shorter pipes than the central system. The cleaned air is immediately returned to avoid underpressure. With high dust concentrations, the cleaning of the individual units is a disadvantage. Various types of such dust removal systems with metal and fiber filters are illustrated.

5192 APTIC NUMBER 15693

Mukai, Shigeru, Yuriko Araki, Masaharu Konishi, and Keiichiro Otomura
DESULPHURIZATION OF COAL WITH SOME OXIDIZING REAGENTS (I). DESULPHURIZATION BY THE TREATMENT WITH CHLORINE GAS AND HYDROGEN PEROXIDE. (Sankazai ni yoru sekitan no datsuryu (I). Enso gasu oyobi kasankasuiso sui ni yoru datsuru). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 48(512):905-911, Dec. 20, 1969. 8 refs.

Desulfurization of coal has been investigated for many years, but no methods have been developed for industrial use. They have been studied mainly in the process of carbonization. The desulfurization method was examined at room temperature before carbonization. The conventional coal preparation technique is insufficient to reduce the sulfur content of bituminous coal, which has a high sulfur content. Desulfurization of Oshima and Ikeshima mine coals by chlorine treatment was attempted. Coal particles were suspended in water, and chlorine gas was introduced into this suspension for 0.5-6 hours. The sulfur content of Oshima mine coal containing 2.16% of sulfur decreased to 1.22%; the sulfur content of Ikeshima mine coal containing 2.58% of sulfur decreased to 1.82%. The desulfurization rate of Oshima mine coal was 42% and Ikeshima mine coal, 30%. The elimination rate of inorganic sulfur of Oshima mine coal was 95% and Ikeshima mine coal, 70%. Inorganic sulfur in coal is practically eliminated by treating with chlorine. Reduction of organic sulfur of Oshima mine coal was 13% and Ikeshima mine coal, 20%. After carbonizing the coal treated with chlorine, the sulfur content of Oshima mine coal became 0.8% and Ikeshima mine coal, 1.2%. The total desulfurization rate of Oshima mine coal was 63% and Ikeshima mine coal, 53%. Unfortunately, however, the coal treated with chlorine gas showed an unfavorable effect on the caking property. This difficulty was solved to some extent by adding some amounts of pitch to the chlorine-treated coal. Desulfurization by treating with the aqueous solution of 3% hydrogen peroxide was also examined. Coal particles were suspended in the aqueous solution of hydrogen peroxide. Desulfurization rate of Yotsuyama mine coal was about 30% and Akabira mine coal, about 30%. Inorganic sulfur was practically eliminated. Caking property did not decrease by treating with hydrogen peroxide.

5193 APTIC NUMBER 15002

Myrick, Richard and Barbara Spencer Marx
THE CONTROL OF INCINERATOR-CAUSED AIR POLLUTION IN NEW YORK CITY: 1946-1965. George Washington Univ., Washington, D. C., Paper 202, 63p., March 1968. 157 refs.
CFSTI, DDC: PB 182 878

New York City's efforts during the past twenty years to assess and control undesirable effects from air pollution caused by incinerators, is documented in case history form. The changing attitudes and approaches, and interplay between different governmental, industrial, and civic entities are shown. Their opposing interests and viewpoints made the struggle to achieve, a solution ineffectual. It is concluded that efforts to control pollution were consistently piecemeal and narrowly conceived. The task was assigned to one governmental department, yet the problem concerned a number of departments. Consequently, the responsibility and authority, together with the necessary coordinating machinery, to provide an across-the-board solution to air pollution did not exist. The city stressed social, political, and behavioral solutions instead of technological ones. It was doubtful that the issue of pollution from apartment house incinerators ever became part of the public awareness. The problem of air pollution abatement started as a relatively insignificant problem. It temporarily became one of high priority, and then subsided. As soon as the Department of Air pollution Control was formed public concern declined. Incidents of attempted control were viewed as a struggle between two factions, each composed of a number of different groups whose power to influence events varied somewhat over time. One faction in the struggle for control comprised those organizations who were most conspicuously and effectively fighting pollution; the citizens groups, dedicated or threatened officeholders, and the press. The strength of this faction was that it has the ability to arouse public opinion and press for action. Its weakness was that it has no administrative power. The other faction consists of apartment building owners and operators, and city officials who were responsible for the operation of municipal facilities. Their strength was that nearly everyone in the city was dependent on them for services. Their weakness was that they lacked both technological and behavioral solutions to the air pollution problem.

5194 APTIC NUMBER 14387

Nabiyev, M. K., A. A. Kulik, P. T. Merenkov, and A. D. Tikhonenko
PURIFICATION OF NITROGEN OF EXHAUST GAS IN THE PRODUCTION OF WEAK NITRIC ACID FOR THE SYNTHESIS OF AMMONIA. (Ochistka azota vykhlopnogo gaza pri proizvodstve slaboy azotnoy kisloty dlya sinteza ammiaka). Text in Russian. Dokl. Akad. Nauk Uz. SSR, 20(11):17-20, 1963. 9 refs.

The small amount of nitrogen oxides in exhaust gases was reduced by natural gas using a nickel catalyst. On a platinum-nickel catalyst, a volume rate of 2800 cu cm was obtained. Complete purification occurred at 500-600 deg. The resulting gas containing 93.85% nitrogen, can be used for the synthesis of ammonia. A method is proposed for a single-step conversion to a nitrogen-hydrogen mixture using water vapor and nitrogen obtained by catalytic purification of exhaust gas.

5195 APTIC NUMBER 15092

Nagai, Hirokazu
DESULFURIZATION OF EXHAUST GAS FROM COMBUSTION FURNACES. (Nensho haigasu datsuryu sohchi). Text in Japanese. (Tokyo Shibaura Electric Co. Ltd., Kawasaki, Kanagawa Prefecture, Japan) Japanese Pat. Sho44-11768. 2p., May 29, 1969. (Appl. March 31, 1969, 1 claim).

The vanadium pentoxide catalyst used most frequently for oxidation of waste sulfur dioxide in the manufacture of sulfuric acid loses its activity by contact with water or low temperature steam. The danger of activity loss is greatest at the base of the stack, where exhaust gas temperature is lowest. The problem is solved according to this patent by providing bypass ducts above and below the catalyst layer. However, when the bypass ducts are closed to allow oxidation of the sulfur dioxide, the catalyst temperature is still too low to effect conversion, and it is not desirable to raise the temperature with a thermal shock of hot gas. For this problem, a duct carrying pre-heated air is brought through the catalyst layer so that the catalyst can be warmed before the

bypass ducts are closed. This hot air duct may also be used to purge the catalyst between operations.

5196 APTIC NUMBER 13732

Nakagawa, Shikazo
ECONOMICAL STATUS FOR RECOVERING SO2 FROM STACK GASES. (Haien datsuryu no keizaisei). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 20(8):57-64, Aug. 1969. 13 refs.

Both direct and indirect desulfurization of crude petroleum require expensive equipment, and neither method removes more than 15% of the total sulfur from the petroleum. Desulfurization of stack gases is more economical, and studies on it have multiplied in recent years. Desulfurization techniques investigated by the Tennessee Valley Authority since 1952 include activated carbon adsorption, catalytic oxidation, the manganese dioxide process, alkaline absorption with ammonia, alkalized aluminum, and limestone. The results of TVA's studies of desulfurization with limestone show that 50 to 60% removal of sulfur dioxide from crude petroleum is obtained by injecting stack gases with dried limestone and that adsorptive potency is related to the roughness of the limestone. This dry process does not need expensive equipment and has other practical advantages. The wet process using limewater removes more than 85% of sulfur dioxide, but has two disadvantages namely, the drop of exhaust gas temperature at the chimney exit and lime deposits on the interior surfaces of equipment. The latter problem can be solved by placing a turbulent floor inside the equipment. To meet the shortage of sulfur and sulfuric compounds, several techniques utilizing SO2 as a source of sulfur have been devised which use ammonium or potassium phosphate to good advantage.

5197 APTIC NUMBER 14946

Nakai, Yoshiyuki
AN APPARATUS FOR CLEANING POLLUTED GAS. (Osenkitai no seijo sochi). Text in Japanese. (Kanagawa Prefecture, Japan) Japanese Pat. Sho44-9444. 5p., May 1, 1969. (Appl. June 13, 1966, 1 claim).

According to this invention, polluted gas is introduced into a processing chamber and flows radially outwards because of an inverted conical obstacle provided at the center of the chamber. A group of ring-shaped obstacles are placed close together concentrically with the conical obstacle, so that a liquid film is formed between the rings. Processing liquid flows down along the surface of the obstacles and forms a film between them. The gas is cleaned by a successive flow of alkaline solution, acid solution, and pure water. The device is applicable to the removal of SO2 from the industrial waste gas or to malodorous organic gases. Dusts can be removed from the air by rinsing with a flow of water alone.

5198 APTIC NUMBER 15624

Nakamura, Hajime, Hideo Satori, Fiyoshi Tabuchi, Shinji Nishizaki, Satoru Kurita, Takashi Watanabe, and Junichi Sakuma
STUDIES ON HYDRODESULPURIZATION OF RESIDUAL OIL BY A TEST APPARATUS OF LARGER SIZE (1). (Jushitsuyu chokusetsudatsuryu no benchisukeru sochi niyoru kento (dai 1 po)). Text in Japanese. Sekiyu Gakkai Shi (J. Japan Petroleum Institute, Tokyo), 12(10):778-782, Oct. 25, 1969. 6 refs.

Hydrodesulfurization of the residuum of Khafji crude oil was studied on a bench-scale test reactor with an inner diameter of 50 mm and a catalyst-bed thickness of 4.36 m. The purpose of the study was to find a size effect of the reaction when applying data obtained by a small-size test reactor with an inner diameter of 30 mm and a bed thickness of 0.14 m to an industrial process. The catalyst had a chemical composition of 6.1% cobalt, 11.6% molybdenum, and 82.3% aluminum trioxide. The rate of sulfur removal was found to be proportional to the square of the sulfur concentration in each reactor. At the same space velocity, however, it was about 20% higher in the larger reactor than the smaller one, probably due to the difference in residence time of oil in the two reactors. An experimental formula was proposed for the rate of sulfur removal consisting of a linear equation with respect to the hold-up factor of the reactor, including the effect of catalyst size and oil properties in addition to the reactor configuration. Experimental results agreed fairly well with the formula. The catalyst's activity deteriorated normally at an early stage of the reaction. A considerable amount of water and ammonia was found in the low-temperature separator. Material balance of the process will be reported elsewhere.

5199 APTIC NUMBER 18983

Naoi, Yashikazu
ELIMINATION OF SULFUROUS ACID GAS BY A NEWLY DESIGNED FILTER OF POROUS MATERIAL. (Atarashii rozai ni yoru sanyusangasu jokyo). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(2):37-39, June 1969.

Because alkaline matter absorbs sulfurous acid gas (SO2) on contact, the gas absorption rate is expected to increase when alkaline matter is spread on the surface of a porous filter. This reaction was tested on a newly designed filter. The test was arranged as follows: sulfurous acid gas was measured according to the law of heat conductivity. The filter was 10 mm thick, the flow rate of the gas was 0.2 m/sec, and the concentration of gas was 20 ppm. Variations in sulfurous acid density did not diminish the collecting rate. The results indicate economical cost, high efficiency, and durability of the new material. It is recommended that the filter be operated at a fixed low speed and with a good collection rate in order to keep it operating for long-term periods. As long as the relative humidity (RH) was over 65%, the collecting rate appeared to be generally constant, but it fell under conditions where RH was less than 45%.

5200 APTIC NUMBER 14863

Nelson, Edwin F.

HYDROCARBON CONTROL FOR LOS ANGELES BY REDUCING GASOLINE VOLATILITY. Preprint, Society of Automotive Engineers, Inc., New York, 24p., 1969. 20 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690087.)

Evaporative emissions from automobiles can be reduced by lowering gasoline volatility. A 3 psi reduction in Reid vapor pressure will reduce evaporative losses by about 50%. A test program was conducted to determine if new and used cars presently on the road in the Los Angeles basin could operate satisfactorily on lower volatility gasoline. A 12% decrease in total vehicle hydrocarbon emissions, equivalent to 220 tons of hydrocarbons per day, could be obtained by lowering the Reid vapor pressure by 3 psi. Gasoline with reduced volatility gave acceptable driveability and could be used to provide a significant reduction in hydrocarbon emission.

5201 APTIC NUMBER 15159

CURRENT STUDIES ON AIR POLLUTION CONTROL. (Taiki osen taisaku no dokoi. Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 48(506):517-521, June 1969. 51 refs.

Studies on the diffusion of pollutants depend today largely on the tracer, wind-tunnel, and computer methods. In the tracer method, fluorescent particles or sulfur hexafluoride have been widely used. The telemetry system used in the U. S. was adopted at the Osaka Air Pollution Control Center and the Chiba Air Pollution Research Institute in Japan. Methods of sulfur oxide removal have been continuously examined. A pilot operation with a capacity of 150,000 cu m/hr was established at a thermal power plant in Yokkaichi; a active carbon treatment was adopted at another pilot plant at the Itsui Thermal Power Plant. Traffic jams are considered to be the major reason for ambient air pollution, and control of automobile emissions would require limitation of traffic and/or exhaust filter equipment.

5202 APTIC NUMBER 14949

INFLUENCE OF SULPHUR CONTENTS ON THE COST OF HEAVY OIL. (Juyuchu iobun no dayukakaku eno eikyo). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(10):35-40, Oct. 1969.

A controversy has arisen between oil suppliers and consumers on how to decide on the price of oil and how to reach an agreement in connection with petroleum refining. This paper consists mostly of analyses of the content of heavy oil imported from the Middle East on which Japan largely depends. The sulfur content of crude and refined oil from various sources is tabulated. Recently, importation of Arabian Heavy, Kafowji, Kuwait, and Wafoura has been decreasing, while importation of Bhaban and Ohban oil has been increasing; the latter contain less sulfur. Hydrogen treatment reduces the sulfur content of Kuwait crude oil from 3.8% to 1%. The oil after topping is distilled and separated from light oil. In addition, the asphalt content is removed and then mixed with the rest in order to produce low-sulfur heavy oil. Two types of desulfurization methods are described. The direct method reduces the sulfur content from 3.8% to 1.2% and the indirect method reduces it from 3.0% to 1.83%; the cost of each method is shown.

5203 APTIC NUMBER 14792

Neuman, George F. (deceased) by Adeline S. Neuman, administratrix APPARATUS FOR REMOVING PARTICLES FROM GASES. (Assignee not given.) U. S. Pat. 3,453,808. 4 p., July 8, 1969. 11 refs. (Appl. May 8, 1967, 1 claim).

The invention is a compact apparatus which removes particles from gas without reducing the velocity of the gas. The apparatus comprises a separating chamber with a cylindrical wall. Gas is delivered by an inlet through one end. An opening is located in the cylindrical wall at the other end and a diffuser button is mounted in a centrally-located inlet. A pressurized stream of liquid is directed against this button, which atomizes the liquid and directs it into a thin spray. The spray crosses the travel path of the gases and dampens the particles which are separated from the gas in the separating chamber when rotary motion is imparted to the gases. The moisture-laden particles travel along the wall of the chamber to the rear opening, while the cleaned gas is directed towards the axial center of the chamber and back toward the rotary motion device. The gas is then directed out of the chamber through an outlet.

5204 APTIC NUMBER 15437

Neumann Bernhard and Erich Goebel
THE ADSORPTION OF SULFUROUS ACID ON PLATINUM, IRON OXIDE, AND CHROMIUM OXIDE. I. (Die Adsorption von schwefliger Saeure an Platin, Eisenoxyd und Chromoxyd. I.). Text in German. Z. Elektrochem., 39(6):352-62, 1933. 24 refs.

The adsorption of SO2 on platinum was studied at high temperatures and adsorption heats measured. The apparatus for determining the adsorption isotherms and the colorimeter for direct measurement of the adsorption heats are described. After the absorption vessel was filled with a specific amount of SO2, pressure loss was checked until no longer discernible. After several hours, more SO2 was added and pressure loss determined again. By this method, 4 to 5 points of an isotherm were measured from 0 mm to atmospheric pressure. The heat developed by adsorption was transferred to a thermopile whose thermoelectric force was measured by a very sensitive millivoltmeter. The platinum catalyst was obtained by precipitation with formaldehyde at -5 C. The results are tabulated. At low pressures the quantity of SO2 adsorbed was rather high; with increasing pressure the quantity slowly decreased. Less SO2 was adsorbed at high temperatures. At 250 C the isotherm is almost linear. Between 300 and 400 C the isotherms have a different form which is explained by the formation of sulfide and the decreased adsorption. After the first two isotherms were obtained, a new way of preparing the platinum was tried (heating the SO2 to 300 C for 5 hours), since

degassing of the catalyst after each test reduced the adsorption ability. These isotherms were used for computation of the adsorbed quantity. Agreement with the measured quantities was not good at low pressures. No direct measurement of the adsorption heats was feasible at the platinum. They were computed instead twice, first according to the Clausius-Clapeyron formula and then from the inclination of the straight lines obtained by plotting the logarithm of the pressure vs. the reciprocal temperature. Agreement between the two computed results was good.

5205

APTIC NUMBER 15765

Newman, Daniel J.
ELIMINATION OF NITROGEN OXIDES FROM GAS STREAMS. (Chemical Construction Corp., New York) U. S. Pat. 3,467,492. 6p., Sept. 16, 1969. 2 refs. (Appl. Nov. 6, 1964, 13 claims).

Conventional processes for eliminating nitrogen oxides from waste gas streams, such as tail gases from nitric oxide production, involve reacting methane with waste gases in one catalytic step, after which the waste gas is passed through a waste heat boiler and/or a gas turbine; or in two catalytic beds with intermediate cooling. The former method presents difficulties in design and operation; the second requires an intermediate exchanger or boiler, as well as ancillary control devices. In the present invention, nitrogen oxides are eliminated by a sequence involving two or more catalyst beds. The waste gas stream is divided into at least two portions; one portion is heated to 900 F and mixed with a proportion of methane less than the stoichiometric requirement for complete reaction with the oxygen and nitrogen oxides contained in the first portion. The gas mixture is then passed through the first bed where the stream temperature is raised to 1000-1400 F. Because the reaction with methane is not complete, the catalyst bed is not subjected to overheating and deterioration. The reacted gas mixture from the first bed is then quench-cooled to 900 F by the addition of a second portion of methane and cold waste gas. If only two beds are used, sufficient methane is added between beds to react with all the nitrogen oxides, and a final reacted stream free of nitrogen oxides is produced from the second bed. Advantages of the process are the substantial savings resulting from the elimination of the intermediate exchanger and reduction of the six of the heater required to preheat gases. In addition, improved operation is provided because the valves controlling the flow of waste gas and intermediate mixtures can be operated at low temperature.

5206

APTIC NUMBER 15251

Nishimura, Hiroshi and Iwao Osoegawa
RECENT UTILIZATION OF FLY-ASH IN JAPAN. (Wagakuni niokeru furaiasshu riyo no genjo). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 47(490):98-106, Feb. 1969. (1968 Printed in error.) 8 refs.

The fly ash recovered by electrostatic precipitators from dry bottom boilers, is primarily utilized for fly ash cement and pozzolan material. In 1966, 645,162 tons of fly ash was used for this purpose in Japan. In addition, the fly ash recovered by multi-cyclones is used as a fertilizer called green ash. The fly ash utilized for this purpose amounted to 81,236 tons in 1966. The coarse ash from a bottom economizer and air heater is utilized as a road-base stabilizer called coal sand. Coal sands from several electric power stations were subjected to various tests of particle size, compactness, compressive strength, and CBR. The mechanical properties of the coal sand differed from station to station, but all of them were useable. During the past two years, 100,000 cu m of coal sand were supplied to the Kyushu district. Recovery of vanadium on a boiler-tube scale began in 1966, and 50 tons of vanadium were recovered in half a year. The figure will be increased when the recovery of vanadium from the dust collector, a process now under study, will be realized on an economical scale.

5207

APTIC NUMBER 13734

Nishino, Kazuyoshi and Katsumi Yamamoto
CONSTRUCTIONAL ALLOY IN A DESULFURIZATION PLANT. (Datsuryu sochi no kinzoku zairyo). Text in Japanese. Sekiyu Gakkai Shi (J. Japan Petroleum Institute, Tokyo), 12(6):450-456, June 1969.

About 90% of the petroleum used in Japan has a high average sulfuric compound concentration of 2.7%. Desulfurization removes sulfur, H2S, and SO2. This paper concerns hydrogenized desulfurization which requires excellent materials and techniques appropriate to high temperature, high pressure, and high concentration of sulfuric compounds. The direct desulfurization of the crude petroleum at normal pressure has a high desulfurization ratio, although the temperature, pressure, and concentration of hydrogen and H2S are significantly high. Thick stainless steel is not only expensive but also very sensitive to corrosion by sulfuration. The severity of corrosion of alloy steel and stainless steel caused by H2S with hydrogen in the dry procedure is significantly increased with the increase of H2S concentration and temperature, and is markedly decreased with the increasing amount of Cr within the alloy. In the wet procedure, however, the corrosion caused by H2S and hydrogen is much more severe than in the dry procedure. In order to avoid corrosive cracking, the use of adequate alloys, including double-layered steel, and/or procedures to remove sulfuric compounds during the time of cooling the equipment are being explored with increasing success. The vessel walls supported by multiple cold layers and internal fire-proof lining resist high temperature, high pressure, and high concentration of H2S. The conducting tubes which connect one vessel to another also need high tolerance against the pressure and corrosive effect of H2S, especially at the connecting portion. A fireproof cast iron alloy, HF, and an improved type HF, which includes 5 to 15% of delta-ferrite, are cheap and corrosion-resistant. Aluminum-containing steel is excellent as an alloy coverage because it is very stable in the presence of high temperature, high pressure, and high concentration of sulfuric compounds.

5208 APTIC NUMBER 14431

Nostitz-Wallwitz, R. von
DUST REMOVAL FROM WASTE GASES STEMMING FROM PREPARATION PLANTS FOR BITUMINOUS HIGHWAY CONSTRUCTION MATERIAL WITH PARTICULAR EMPHASIS ON CLOTH FILTERS. (Abgasentstaubungen fuer Aufbereitungsanlagen bituminoeser Strassenbaustoffe unter besonderer Beruecksichtigung der Gewebefilter). Text in German. Bitumen, Teere, Asphalte, Peche, 20(8):173-180, April 1969. 2 refs.

After citing all types of conventional dust collectors, cloth filters, which have become increasingly popular for dust removal from waste gases from preparation plants for bituminous highway construction materials (asphalt), are discussed. This interest has come since the development of fibers which are resistant to weakly acidic and alkaline media at high temperatures. There are two types of cloth filters, namely, envelope types and bag types. A bag filter dust removal system in a preparation plant with a capacity of 180 t/hr is described. The waste gas cleaning system consists of a cyclone for preliminary dust removal and a bag filter made of nylon fiber on polyamide basis. It can resist long-term temperatures between 220 and 230 C and peak temperatures up to 270 C. The cyclone removes 80 to 90% of the particles larger than 0.09 mm. About 10 to 20% of the dust is removed by the cloth filter, which has four cylindrical chambers with a circular arrangement of the tubes. The dirty gas flows through the tubular bags from outside to inside so that dust is precipitated outside and dislodged from there by a reverse air jet. Measurements taken in the cleaning system showed that the soot content of the dust was at times as high as 10.5 to 12%. After one year of operation, the first ruptures were discovered. Detailed information is provided on various operating parameters such as waste gas temperature, CO2 content, and dust content of the chemical gas.

5209 APTIC NUMBER 15768

O'Hara, Mark J.
HYDRODESULPHURIZATION CATALYST AND PROCESS FOR TREATING RESIDUAL FUEL OILS. (Universal Oil Products Co., Des Plaines, Ill.) U. S. Pat. 3,471,399. 4p., Oct. 7, 1969. 6 refs. (Appl. June 9, 1967, 10 claims).

An improved catalyst particularly adapted to the hydrodesulfurization of residual fuel oils (including the residuum produced by separating light fractions from crude petroleum) comprises a Group VI-B metal, usually molybdenum, and a Group VIII metal, usually nickel, on an aluminum-silica carrier material. The aluminum-silica weight ratio is from about 3:1 to 9:1. The catalyst is characterized by a pore volume from about 0.3 to 0.5 cu cm/gr, a pore diameter from about 60 to 100 A, a surface area from about 150 to 250 sq m/gr, and an apparent bulk density from about 0.2625 to 0.875 gr/cu cm. These desired physical properties are developed by the co-gelation of an alumina sol and a silica sol to form spherical gel particles. In the process, the silica is set thermally and the alumina is set chemically with ammonia furnished by an ammonia percursor. The percursor continues to hydrolyze during the aging of the gel particles, effecting further polymerization of the alumina-silica and thus establishing the pore characteristics. The composite catalyst is usually dried from two to eight hours in a steam drier, then at 212 to 260 F in a drying oven, and oxidized in air at 800 to 1500 F for one to eight hours. Residual fuel oil treated with the catalyst is recovered substiantially free of sulfur compounds.

5210 APTIC NUMBER 14771

Oblander, Kurt
INSTALLATION FOR REDUCING THE NOXIOUS EXHAUST GAS EMISSION OF INTERNAL COMBUSTION ENGINES. (Daimler-Benz A.-G., Stuttgart, Germany) U. S. Pat. 3,461,[illegible]8. 4p., Aug. 19, 1969. 4 refs. (Appl. Aug. 29, 1967, 15 claims).

In order to achieve at the idling speed as small as possible a CO emission in the exhaust gases, it is desirable to adjust the idling speed mixture as lean as possible. However, a limit is imposed to the extent of such lean adjustment by the rotational operation of the engine. This limit can be further displaced in the direction toward a more lean mixture adjustment by a better mixture preparation. An installation is described for reducing the emission of harmful exhaust gases in internal combustion engines in which the idling air line which supplies combustion air to the cylinders in the idling speed range, by-passing the throttle valve controlled by the gas pedal, extends in direct proximity to the exhaust gas line so as to provide a preheating of the idling air by the exhaust gases. The exhaust gas line and the idling air line may be advantageously combined into a unitary structure in such a manner that a zone is additionally formed opposite the injection nozzles within each individual suction pipe connection which is heated by the exhaust gas line for improving the fuel preparation.

5211 APTIC NUMBER 15320

Ochs, H. J.
ELECTRIC AIR FILTERS IN VENTILATION AND EXHAUST SYSTEMS. (Elektro-Luftfilter in Be- und Entlueftungs-Anlagen). Text in German. Metall., (9):915-919, Sept. 1969.

After a brief review of the history of the electrostatic precipitator, structural and functional details of the most common type for air cleaning and functional details are reviewed. The unit, which operates according to the Penney system, consists of an ionizing zone with a positive d.c. voltage of 13 kV and a collection zone with a d.c. voltage of 6.5 kV. The collection efficiency of the precipitator depends on the properties of the dust, its electrical conductivity, and its chemical and physical composition. Temperature, relative humidity, composition of the carrier gas (air), flow rate, dust concentration, and grain size of the dust particles also determine collection efficiency. The formula for mathematical computation of the collection efficiency is given; it is based on a uniform gas speed over the entire cross section of the precipitator. The discoloration test is briefly discussed as a practical method for determining collection efficiency. At an influx rate of 1.7 m/sec, the collection efficiency determined by this method was found to be 90%. Such dust separators are primarily used in air conditioning systems. Usually another

filter for collecting coarse dust particles precedes the precipitator.

5212 APTIC NUMBER 13406

Ochs, H. J.
VENTILATION AND WASTE AIR PROBLEMS IN ELECTROPLATING PLANTS. (Luftungs und Abluftprobleme in galvanischen Betrieben.) Text in German. Metall., 22(10):1016-1020, Oct. 1968. 7 refs.

In electroplating plants, the gases, vapors and mists originating during the plating process contain highly toxic or otherwise noxious constituents which endanger all personnel working in these plants. The present paper deals solely with the problem of removal of these substances from the workshops by appropriate ventilating equipment which also purifies exhaust air and gases before releasing them into the atmosphere. Maximum permissible concentrations of noxious substances in the shop air are given. The paper deals mainly with the design of hoods and ducts, the dimensions of exhaust fans, prevention of ventilating equipment corrosion, and computation of the required volume rate of flow of inlet air. The latter should be based on the requirement that the concentration of noxious substances remain below the maximum permissible value.

5213 APTIC NUMBER 15691

Ohira, Toshio, Junji Mutsuma, Isao Takahashi, Chotaro Ohno, and Tinzo Nakano
SURVEY OF THE PERFORMANCE OF PUBLIC NUISANCE PREVENTION INSTALLATIONS FOR DUSTS. (Funjin kogaiboshi shisetsu no sokuteichosa). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(8):473-485, Aug. 25, 1969.

Two cotton factories and two metal factories were chosen for dust analysis surveys. Dusts were measured at the inlet and outlet of the dust collector by a method specified in the Japanese Industrial Standard Z8808. Total sulfur oxides were analyzed by the Torine method of the Japanese Industrial Standard K0103. The conventional method for measuring dusts was inadequate for slender fibers such as cotton, because the sampling opening was jammed by the dust, causing error in the measurement. The recovery of cotton from the dust for use as a raw material appeared to be impractical because of the cost of labor and the price of the cotton. Cyclone type dust collectors were found to be the most appropriate for public nuisance prevention. The dust box which clearly shows the dust accumulation is desirable. The wet type electrical dust collector of compact size was found to be very effective and suitable for middle or small size industries. The water used for the collector, however, was discharged without processing, giving rise to water pollution. Future improvement is expected so that another public nuisance will not be induced by removing one.

5214 APTIC NUMBER 15620

Ohya, Masaaki
NITROGEN OXIDES FROM STATIONARY COMBUSTION FURNACE. (Koteinenshosochi karano chissosankabutsu). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 5(8):448-456, Aug. 25, 1969. 10 refs.

Sources of nitrogen oxides in the atmosphere and existing methods of control are reviewed. Nitrogen oxides are monitored mainly by electrical conductivity measurements or photo-electric colorimetry. In urban areas, they are primarily produced by the combustion of heavy oil, gasoline, or coal. The automobile exhaust is the main source of ambient nitrogen oxides, which are produced by the oxidation of nitrogen in the combustion chamber air of the engine. Their amount is determined primarily by the fuel ratio. Nitrogen oxides emission from stationary combustion furnaces, on the other hand, are not very serious at present, but have growing importance. Nitrogen oxides are more difficult to control than sulfur oxides; control is effected either by a wet system using venturi scrubbers, or a dry system using adsorbents, such as an active carbon. Several ways are described for controlling combustion. It is emphsized that those methods of combustion control do not apply to other harmful pollutants. A method of simultaneous removal of sulfur dioxide and nitrogen oxides is also described, together with the use of a catalyst for converting SO2 and nitrogen oxides into sulfuric and nitric acids respectively, and subsequently removing these acids by rinsing. Future development of control techniques is desired.

5215 APTIC NUMBER 15772

Okuno, Toshihide
THE REACTION BAD ODOR SUBSTANCES WITH OZONE. (Akushu seibun to ozon no hannosei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(8):633-639, Aug. 15, 1969. 8 refs.

The removal of industrial odors by the use of ozone oxidation was studied, and their properties and behavior were described with the introduction of electron theory. Malodorous components are amine-ammoniacal compounds, lower aliphatic acidic compounds, sulfurous compounds, ofefin-paraffin hydrocarbons, and other organic compounds. Olefinic hydrocarbons have a characteristic odor and a reaction mechanism for olefinic hydrocarbons and ozone was described. One of the most general reactions of the carbon-carbon double bond is an addition of ozone and rearrangement of the resultant ozonide whereby the ozonide is directly hydrolyzed by boiling with water. Secondary and tertiary amines were employed to examine reactivity and reaction products. Reactivity was determined by measuring residual ozone quantity, and reaction products were monitored by gas-chromatography. Tertiary amines reacted extensively with ozone and formed various compounds. Acrylic ester monomer, used as a raw material of acrylic acid resin, is very odorous. An oxidation experiment using acrylic ester and methacrylate was done for the removal of this odor. Acrylic ester reacted faster than methacrylate; a reaction of acrylic ester with ozone proceeded relatively fast, so this odor can most readily be removed by selecting appropriate reaction conditions. In conclusion, not all odorous components can be removed by ozone oxidation, due to the difficulty in reducing 1 ppm of malodorous components to 1 ppb (99.9% removal

rate). Optimum reaction conditions and apparatus must be found for the use of ozone reaction methods on odorous sources.

5216 APTIC NUMBER 10821

Olcott, Thomas M.
DEVELOPMENT AND DESIGN OF AN ISOTOPE-HEATED CATALYTIC OXIDIZER TRACE CONTAMINANT CONTROL SYSTEM (U). Lockheed Missiles and Space Co., Sunnyvale, Calif., Biotechnology Organization, Contract NAS 1-7433, NASA CR-66739, 277p., Feb. 28, 1969. 79 refs.
N 69-18755

The development and design of an isotope-heated catalytic oxidizer trace contaminant control system is described. The program included establishing pre- and post-sorbent bed designs to control potentially poisonous contaminants (e.g., H2S, NO2, SO2, and NH3) and to control contaminants that might produce undesirable products. Lithium hydroxide was selected as the pre-sorbent material. The sizing of the pre-sorbent bed was accomplished by establishing the stoichiometric quantity of lithium hydroxide required to remove the poisonous contaminants and by establishing a satisfactory dynamic performance level. A trade-off was made between the weight penalty due to the bed and canister fixed weight and the weight penalty associated with the fan head rise required for flow to establish the bed configuration. To determine the pre-sorbent bed requirements, a regenerative charcoal main sorbent bed system, suitable for the proposed program, was postulated, and its effect on the contaminant load was assessed. A 180-day evaluation test of the pre-sorbent bed, catalytic oxidizer, and post-sorbent bed was conducted. Tests established the fabrication and joining techniques and the compatability between the isotope heat source materials of construction. Additional tasks included evaluation of candidate electric heater concepts for use in a simulated isotope heat source and evaluation of thermal insulation concepts. The insulation performance was better than expected and resulted in the reduction in the required insulation thickness from 1.5-1.0 inches. Solid insulation was selected for the final design. The detailed design of the isotope heated catalytic oxidizer system included a stress analysis of the main structure and a review of the thermal characteristics. The resistively heated unit is an exact duplicate of the radioisotope-fueled unit, except that the thermal power is obtained from a resistively heated element located in the fuel cavity, and heater element and thermocouple leads pass through the heat exchanger core. (Author abstract modified)

5217 APTIC NUMBER 15614

Olesov, N. A.
EFFECT OF NAPHTHENIC SOAP ON THE PROPERTIES OF INDUSTRIAL DUST. (Deystviye mylonafata na svoystva tekhnologicheskoy pyli). Text in Russian. Tsement, no. 9:14-15, 1969. 3 refs.

Pilot-plant studies revealed that the introduction of naphthenic soap into furnace flue gas increases the fluidity of the dust by approximately 20% and reduces R2O (R is an unspecified radical) and SO3 content of the dust by a factor of about two. The specific resistivity of a layer of collected dust remained within the same limits as dust without the additive (1000 to 10,000 megohm-cm) thus maintaining electrostatic precipitator effectiveness. Addition of naphthenic soap to dry ground raw material such as cement increased the mobility of the raw material powder by 6-7% and its volumetric weight by 5-7%. In addition, the load on the main grinder drive was reduced by 5%, improving grinder operation and reducing power consumption. The experiment lasted for 70 hrs, during which time 2.93 tons of dry naphthenic soap were introduced.

5218 APTIC NUMBER 15690

Oloman, C., P. F. Murray, and J. B. Fisk
THE SELECTIVE ABSORPTION OF HYDROGEN SULFIDE FROM STACK GAS. Pulp Paper Mag. Can. (Quebec), 1969:69-74, Dec. 5, 1969. 7 refs. (Presented at 55th Annual Meeting of the Technical Section, Canadian Pulp and Paper Association, Montreal, Jan. 28-31, 1969.)

Selective absorption of hydrogen sulfide in a wet scrubber is proposed as a method of reducing the odor from kraft pulp mill recovery stack gases. A solution of sodium carbonate and bicarbonate, which is 2M in sodium, is in equilibrium with the carbon-dioxide content of the recovery stack gas and has a pH of about 9.5. The solution will selectively absorb hydrogen sulfide from the stack gas provided its sulfide content is kept low. Hydrogen sulfide absorption efficiencies of over 90% were obtained in a pilot absorption unit consisting of a packed column working in series with air sparged liquor oxidizers. The process rates indicated that an efficient absorption system for a 500 t.p.d. kraft pulp mill would require a 20-ft-diameter absorption column, with 10 ft of packing, using 3000 g.p.m. of recyling carbonate liquor. The value of the recovered chemicals was not expected to pay for the cost of recovery-gas scrubbing. (Author abstract modified)

5219 APTIC NUMBER 13669

Ontario Research Foundation, Toronto
THE REMOVAL OF SULPHUR GASES FROM SMELTER FUMES. Toronto, Legislative Assembly of Ontario, 149p., 1967. 1004 refs.

Available processes for removing or recovering sulfur dioxide are briefly discussed in the main body of the report. Detailed descriptions of those processes which have reached the stage of commercial or semi-commercial development, together with information concerning cost figures and applications for the smelters of Northern Ontario, are given in an appendix. The processes covered at length include the direct production of sulfuric acid from smelter fumes, the ammonia absorption process at Trail, B.C., the anhydrous dimethylaniline process used at Selby, California, the Battersea fuel-gas lime washing process, and the Pulham lime slurry process. An account is given of the manufacture of sulfuric acid at Garfield, Utah, from sulfur dioxide contained in the waste fumes of copper converters. Processes operated on a pilot plant scale include the Hall process, the wet and dry thiogen process, and the chemical

generation process developed at the University of Illinois. The Bosvell Process is briefly described, and developments in processes for removing hydrogen sulfide and recovering elemental sulfur from natural gas are reported. In addition, the report contains a substantially complete list of American patents bearing on sulfur recovery from ores and waste gases, a representative list of British, German, Canadian, French, Swedish, Belgian, and Australian patents, and a selective bibliography of the literature on sulfur dioxide and related compounds.

5220 APTIC NUMBER 15219

Oropeza, Esther and Violet E. Oropeza
AIR PURIFIER DEVICE. (Assignee not given.) U. S. Pat. 3,465,504. 3p., Sept. 9, 1969. 16 refs. (Appl. Oct. 26, 1967, 1 claim).

An air purifier device has three chambers connected in a series and fans to draw air through the chambers in sequence. The first chamber is a collection chamber for receiving impure air; the second chamber is plastic lined and provided with a plurality of sprays to produce a fine mist to precipitate even fine particles from the air; and the third chamber filters the washed air so that exhaust air is free of fumes and other impurities. The device operates automatically and is easily cleaned and repaired. It is particularly suited for industrial use but can be used wherever exhaust is heavily contaminated by fumes.

5221 APTIC NUMBER 14255

Palmeri, C. and F. Penzanigo
COMBUSTION PRODUCTS OF DIESEL FUEL. I. THE EFFECT OF AN IGNITION IMPROVING ADDITIVE ON THE NITROGEN OXIDE AND CARBON MONOXIDE CONTENT. (Prodotti di combustione di combustibili diesel. I. Effetti di un additivo promotore di accensione sui contenuti in ossido di azoto ed ossido di carbonio). Text in Italian. Riv. Combust., vol. 13:819-831, June 1959. 3 refs.

Investigations were made on the effect of gasoil compositions, the presence of ignition improvers, and of engine operation conditions on the nitrogen oxide and carbon monoxide content of a C.F.R. F-5 engine exhaust gas. With all the gasoils used during these tests, the highest nitrogen oxide contents were observed when the engine was running on intermediate loads. The effect of additives was seen only when the engine ran at minimum speeds. It was found that nitrate base additives reduce the exhaust gas CO content, particularly with low cetane number gasoils in engines on high loads. (Author summary modified)

5222 APTIC NUMBER 14809

Parsons, Terry, Gary D. Schroeder, and David DeBerry
APPLICABILITY OF METAL OXIDES TO THE DEVELOPMENT OF NEW PROCESSES FOR REMOVING SO2 FROM FLUE GASES. TRACOR, Austin, Tex., Contract PH-86-68-68, Proj. 004-009, Task 10, Rept. 69-579-U, Vol. I: 123p., Vol. II: 1041p., July 31, 1969. 345 refs.

CESTI: PB 185562 (Vol. I)
CESTI: PB 185563 (Vol. II)

The oxides of 48 metals were screened according to the thermodynamics of their reaction with sulfur oxides to eliminate from consideration as potential sorbents those oxides not capable of reducing to 150 ppm the sulfur oxide concentration in exiting flue gas of power plants. The screening process reduced the field of potential sorbents to the oxides of sixteen metals, most of which appear in Groups VI, VII, and VIII of the periodic table. These were prepared in a kinetically active form by calcining a salt which decomposed to the oxide at a low temperature, and the rates of their reaction with SO2 in a simulated flue gas atmosphere were determined using isothermal gravimetric methods. The field of potential sorbents was reduced to the oxides of copper, chromium, cobalt, iron, nickel, and cerium, all of which had reaction rate constants within the economically feasible range of greater than 10/sec. The rate data provided inputs to cost estimation calculations for the economic feasibility studies. These consisted of equipment design and sizing, and estimation of the capital investment and gross annual operating cost for a sorber-regenerator system using a fluidized bed model. The cost estimations were carried out for the three best potential sorbents. Process flowsheets including heat and material balances were also prepared. The results for copper and iron oxides are a preliminary estimations for a capital investment of $8 million and a gross annual operating cost of $3 million for a 1000 MW power plant. Vol. I includes descriptions and data of the thermodynamic, kinetic, and economic feasibility studies and abstracts of technical memoranda; Vol. II consists of the unabridged technical memoranda and associated data.

5223 APTIC NUMBER 14780

Paterson, Norman J. and Ronald P. Poselius
DESULFURIZATION AND BLENDING OF HEAVY FUEL OIL. (Chevron Research Co., San Francisco, Calif.) U. S. Pat. 3,464,915. 7p., Sept. 2, 1969. 2 refs. (Appl. March 10, 1967, 3 claims).

The invention relates to a catalytic hydroconversion process for purifying hydrocarbon oils and is particularly concerned with catalytic hydrodesulfurization of heavy oils to produce fuel oils of acceptable pour point and viscosity. High-sulfur content petroleum residuum is separated above 650 F into an asphaltic fraction and a nonasphaltic fraction, and the nonasphaltic fraction is desulfurized in the presence of light hydrocarbon distillates boiling in the kerosene and light diesel fuel boiling ranges. The desulfurized nonasphaltic fraction is then blended with the asphaltic fraction. The distillate enhances desulfurization and inhibits hydrocracking of the heavier nonasphaltic fraction. Blending compatibility of the two fractions is preserved, and the blend has improved pour point and viscosity characteristics. Superior results are obtained when the catalytic agent used for desulfurization is an alumina-silica composite carrier, promoted with molybdenum and nickel.

5224 APTIC NUMBER 14389

Perov, Ye. V.
ABSORPTION OF NITROGEN OXIDES BY MAGNESIUM, STRONTIUM, AND BARIUM HYDROXIDES. (Poglosheniye okislov azota gidratami okislov magniya, strontsiya, bariya). Text in Russian. Tr. Novocherk. Politekhn. Inst., vol. 121:57-60, 1961. 4 refs.

Absorption of nitrogen oxides in concentrations of 0.25, 0.5, and 1.0% with a flow rate of 0.5 liter/min at 25 and 35 C over powdered magnesium hydroxide with a moisture content of 3% was studied experimentally. Absorption rate was found to drop off considerably after 60-70 min, at which time the absorbent may be washed with water to remove magnesium nitrate and nitrite. Experiments with Ba(OH)2-8H2O and Sr(OH)2-8H2O were carried out at 15 C with a nitrogen oxide concentration of 0.5% and a flow rate of 0.5 liter/min. The strontium hydrate crystals retain their physical properties much better than does the barium hydrate, which readily deliquesces, making it difficult to use as an absorbent.

5225 APTIC NUMBER 15323

Petroll, J.
SOME PROBLEMS OF ELECTROSTATIC PRECIPITATION IN POWER PLANTS. (Einige Probleme der elektrischen Staubabscheidung in Kraftwerken). Text in German. Energietechnik, 19(10):439-444, Oct. 1969. 9 refs.

The exponential law derived by Deutsch for monodisperse, homogeneous dust is not applicable to the designing of electrostatic precipitators, primarily because the dust encountered here is polydisperse. The difference between the exponential precipitation characteristic and the one obtained experimentally for polydisperse dust is illustrated in a diagram. A new formula based on the physical processes occurring in electrostatic precipitation is given. It takes into account mechanical particle precipitation, ionization time for the suspended particles (which is much longer than has always been assumed), and grain size distribution of the dust. The formula permits improved dimensioning of the precipitators, but it is pointed out that no pure theoretical planning is yet possible. A large amount of experimental data is also required. The probability of achieving a predetermined collection efficiency can then be computed. Dimensioning of the electrostatic precipitator depends on flue gas quantity, dust content of the uncleaned gas, the content of unburned material, temperature and humidity of the flue gas, and on a uniform gas speed across the inlet. For reliable operation of the unit, the combustion process must be adequately conducted, fly ash and false air must be prevented from entering the unit, and the power supply unit must be dependable.

5226 APTIC NUMBER 15316

Petzold, Dietmar
REACTIONS OF ORGANIC SULFUR COMPOUNDS IN CITY GAS WITH MECHANICALLY ACTIVATED ALPHA-FE2O3. PART I. ETHYL MERCAPTAN (C2H5SH). (Reaktionen von organischen Schwefelverbindungen in Stadtgas mit mechanisch aktiviertem alpha-Fe2O3. Teil I. Aethylmercaptan C2H5SH). Text in German. Gas Wasserfach (Munich), 110(43):1146-1150, Oct. 10, 1969. 18 refs.

A gas mixture with the composition of city gas was passed over mechanically activated alpha-Fe2O3. Small amounts of ethyl mercaptan (C2H5SH) or carbon disulfide were added to the gas mixture. The test apparatus consisted of a gas supply part, a doser, a contact oven, and a gas chromatograph; the gas throughput was 1 l/hr. The entire experiment lasted 46 hrs. The exact composition of the catalyst was determined after the reaction. The results show that at temperatures below 350 C, gaseous C2H5SH was converted to (C2H5S)2, SO3, CS2, and COS. The Fe2O3 catalyst began to change at 275 C to gamma-Fe2O3, Fe3O4, FeS, Fe, iron carbide, and amorphous carbon. The oxygen content of the gas was consumed at higher temperatures by oxidation of hydrogen. No release of sulfur by FeS occurred. At temperatures above 350 C, the entire sulfur content of the C2H5SH is converted to solid phase FeS. The gas was completely desulfurized.

5227 APTIC NUMBER 15913

Pinaev, V. A. and G. K. Krushinskaya
SORPTION OF SULFUR DIOXIDE BY SEMICOKES MADE BY LOW-TEMPERATURE CARBONIZATION OF BROWN COAL. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 41(12):2449-2451, Dec. 1968. 6 refs.

Experiments were carried out to determine the ability of semicokes obtained by carbonization of brown coal to remove sulfur dioxide from gas streams. At 120 deg and below the sorptive capacity of the semicokes for SO2 in an unhumidified gas stream was 1.0-1.2 wt%. When the gas stream was humidified, the capacity of the brown coal semicokes for SO2 was approximately 2.3-2.7 wt%. Adsorption of SO2 was accompanied by adsorption of water vapor, indicating that the sorption capacity of semicoke is increased in the presence of water vapor, which ensures formation of H2SO4 on the adsorbent surface. Semicokes with a low sulfur content were identified in carbonizations carried out at 500-520 deg. Cokes with initial sulfur contents of 0.2 and 0.3% had sorptive capacities of 3.5 and 8.0 wt%, respectively.

5228 APTIC NUMBER 13780

Pinayev, V. A., N. P. Pitelina, A. T. Novikov, and G. V. Sosekina
CYCLIC POTASH-MAGNESITE METHOD OF REMOVING SULFUR DIOXIDE FROM GASES. (Tsiklicheskiy potashno-magnezitovyy metod ochistki gazov ot sernistogo angidrida). Text in Russian. Zh. Prikl. Khim., 40(10):2351-2353, 1967. 8 refs.

Industrial wastes containing K2CO3 or K2SO3 can be used to improve the cyclic magnesite method of removing sulfur dioxide from gases. Removal of 98-99% of SO2 at sorption temperatures of 40-50 C with initial SO2 concentration of 0.15-0.6 vol % is predicted. This method has been tried experimentally and is

immune to the presence of admixtures such as phenol, H2S, sulfur, and selenium, and can be used to purify hot dusty gases without precooling or dust removal.

5229 APTIC NUMBER 15486

Pinayev, V. A., M. P. Pitelina, A. T. Novikov, and G. V. Sosekina
CYCLIC POTASH-MAGNESITE METHOD FOR REMOVING SULFUR DIOXIDE FROM GASES. (Tsiklicheskiy potashno-magnezitovyy metod ochistki gazov ot sernistogo angidrida). Text in Russian. Zh. Prikl. Khim., 40(10):2351-2353, 1967. 8 refs.

Removal of sulfur dioxide in starting concentrations of 0.15-0.6 vol % at 40-50 C by the magnesite method may be increased from 95-96% to 98-99% by the addition of small amounts of K2CO3. A proposed scheme for utilizing this method is described. The method was demonstrated experimentally which is not affected by phenol, H2S, sulfur, or selenium impurities. It permits purification of gases without preliminary cooling or dust removal and is regarded as promising in comparison with existing methods.

5230 APTIC NUMBER 18768

Pinayev, V. A., M. P. Pitelina, G. V. Sosekina, and G. K. Krushinskaya
METHOD FOR REMOVING SULFUR DIOXIDE FROM GASES. (Sposob ochistki gazov ot dvuokisi sery). Text in Russian. (State Scientific Res. Inst. of Industrial and Sanitary Gas Purification, Moscow) USSR Pat. 198,777. 2p., April 12, 1967. (Appl. March 29, 1966, 2 claims).

The proposed method differs from existing ones in that a suspension of trihydrated magnesium sulfite with the addition of 0.005-0.01% para-phenylenediamine is used as the absorbent. This allows gas purification at higher temperatures, significantly simplifying the process. Purification of 99.6% is reported for an initial gas temperature of 120 C with the absorbing suspension at 62 C and a starting SO2 concentration of 5.8%.

5231 APTIC NUMBER 15467

Pirlet, Georges
PROCEDURE FOR REMOVAL OF SULFUR DIOXIDE AND OTHER VALUABLE PRODUCTS CONTAINED IN CERTAIN GAS MIXTURES. (Procede pour l'enlevement de l'anhydride sulfureux et autres produits de valeur contenus dans certains melanges gazeux). Text in French. (Assignee not given.) French Pat. 779,029. 3p., March 1928, 1935. (Appl. Dec. 19, 1933, 2 claims).

The invention concerns a procedure for removal of sulfur dioxide from gas mixtures by which it is obtained in pure liquid, or gaseous form or in compound form as solid or dissolved sulfites of ammonia, alkali metals, alkali-earth metals, or other metals. The gas mixtures are treated in the presence of water with a base or salt whose acid is displaceable by SO2. The sulfite obtained in solution is decomposed at an appropriate temperature by an acid and/or an acid salt which displaces SO2. The released SO2 resulting from the acid attack on sulfites is separated from water vapor, which is removed by cooling, then dried by known methods, cooled by vaporization of anhydrous NH3, and finally compressed, if necessary, under conditions suitable for liquefaction. Sulfuric acid used for drying SO2 may be used to attack the sulfite solutions. For chemical fixation of SO2, water is used in such a manner that all sulfite formed is dissolved, while the resulting solution contains practically no dissolved CO2. Water used for direct cooling of hot sulfur-containing gases is used in a closed circuit after its heat is transferred to solutions which are to be concentrated or evaporated. In the treatment of sulfur-containing gases resulting from decomposition of the sulfites, SO2 obtained by the condensation water is recovered either by cooling of the hot gases after combustion or by a chemical treatment of these gases. The sulfite solutions can be evaporated or concentrated by heating with the hot sulfur-containing gases.

5232 APTIC NUMBER 15916

Plekhotkin, V. P., A. P. Kitts, and S. S. Gavlovskaya
DYNAMICS OF SORPTION OF NITROGEN OXIDES BY AV-17 AND EDE-10P ANION EXCHANGE RESINS. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 42(7):1610-1613, July 1969. 8 refs.

Ion exchange resins are being used increasingly in the sorption of corrosive gases, but the dynamics of sorption by ion exchangers are relatively unknown. An investigation of the dynamics of sorption of nitrogen oxides by AV-17 and EDE-10P anion exchange resins showed that swollen EDE-10P resins have the longest time of protective action. Sorption by an EDE-10P resin is most effective at low linear gas velocities and at concentrations of nitrogen oxides not exceeding 8/mg l. These are the concentrations present in waste gases from nitric acid production processes in which gases are passed through alkaline absorbers before being discharged to the atmosphere. A study of the feasability of installing anion exchanger filters after the absorbers could help solve the problem of complete removal of nitrogen oxides from industrial waste gases.

5233 APTIC NUMBER 15565

Plumley, A. L., J. Jonakin, J. W. Martin, and J. G. Singer
REMOVAL OF SO2 AND DUST FROM STACK GASES. (PROGRESS REPORT ON THE C-E AIR POLLUTION CONTROL SYSTEM). Combustion, 40(1):16-23, July 1968. 3 refs. (Presented at Southeastern Electric Exchange, Richmond, Va., April 11-12, 1968.)

To meet the needs of utilities for commercially practical systems for reducing SO2 emissions, a high-efficiency, low-cost combination sulfur dioxide and dust removal system was developed that does not depend on by-product sale. The process involves feeding an alkaline earth additive to the combustion chamber of a steam-generating unit and wet scrubbing the flue gas leaving the air heater. Three systems have been tested and installed. (Each is guaranteed to remove 90% of the particulate matter, and SO2 to a level equivalent to burning 05% sulfur coal.) One

unit has separate additive feed, but used a liquid-couple stack gas reheating circuit and also a clarifier for concentration of the solids. Two other units have hot water heaters, use fly ash settling pond for clarification, and one will mix limestone with the coal and the other will use separate injection. Results of field and laboratory tests suggest removal of SO3 should be total, SO2 to 99.6% and a dust collection efficiency 99.0% or better. The estimated cost of removal of sulfur oxides and fly ash from 500-Mw unit burning coal with 10% ash and 3% sulfur, is about 1.5 cents/1,000,000 Btu of coal (1968), including fixed and operating charges and credits.

5234 APTIC NUMBER 15739

Popovici, N., P. Potop, I. Prindue, and P. Anghel
PROPOSED EQUIPMENT FOR RETAINING SO2-CONTAINING RESIDUAL GASES DERIVED FROM THE MANUFACTURE OF SULFURIC ACID, IN THE CONTEXT OF A FERTILIZER MANUFACTURING PLANT AND UNDER FAVORABLE ECONOMIC CONDITIONS. (Proiectarea unei instalatii de retinere a gazelor reziduale cu SO2 de la fabricarea acidului sulfuric in cadrul unei uzine de ingrasaminte complexe, in conditii economice avantajoase). Text in Romanian. Rev Chim. (Bucharest), 18(1):80-88, 1967. 17 refs.

Economic development of Rumania calls for increasing the production of chemical fertilizers, including ammonium phosphate, to 480,000 tons in 1965 and 1,300,000 tons in 1970. The need for industrial sulfuric acid is also increasing. Ammonia can be used to remove SO2 from exhaust gases and phosphoric acid to decompose the ammonium sulfite-bisulfite solution. Optimum values, when working with an SO2 concentration of 0.2-0.3%, are a liquid-gas relationship of about 3.5 per thousand; a SO2/NH3 ratio of 0.7; a maximum and 50 C maximum concentration of ammonium sulfite-bisulfite in solution of 700 grams per liter; absorption temperature. Phosphoric acid is used as decomposing agent of the bisulfite solution, preferably with a gas flow of 75 meters per second. Optimum values to be achieved include: a 50% P2O5 concentration in the phosphoric acid; an H3PO4/NH3 ratio of 2.2 minimum; an operating temperature of 95 C; and a liquid-gas ratio of .0043. Under these conditions a 90% recovery of SO2 is possible. A device designed to achieve these conditions can process about 48,000 Nm3 per hour of residual gases containing 0.2-0.3% SO2 at a minimum operating cost. This cost (for water, steam, and electrical energy) is offset by the amount of extra sulfuric acid obtained: about 3,500 tons per year.

5235 APTIC NUMBER 15736

Potop, P., I. Creanga, and C. Teodorescu
RECOVERY OF SULFUR DIOXIDE FROM RESIDUAL GAS BY WET ABSORPTION, USING TWO PURIFICATION STEPS. (Valorificarea bioxidului de sulf din gaze reziduale prin absorbtie umeda in doua trepte de purificare). Text in Romanian. Rev Chim. (Bucharest), 17(6):331-336, 1966. 28 refs.

Rumanian government regulations require that SO2 emissions not exceed 0.1 ppm and that absorption devices reduce chimney emissions to 0.05% by volume. Three wet absorption processes are described: 1) with a raw dolomite suspension (Mg equals 20.25%, CaO equals 30.55%) with MnSO4 as catalyst; 2) with manganese ore (rhodonite, rhodochrosite) containing 28% MnO; 3) with NH4OH in the presence of activated carbon. To obtain a high retention of SO2 a two-step absorption can be used. The first absorption step gives a maximum SO2 retention of 90-95% and a recoverable by-product. If dolomite is used, a high quality of MgO is obtained and SO2 concentration in the waste gases is reduced to 0.05%. If manganese ore is used, 80% of the manganese is recovered in the form of Mn2O3, while the purified gases contain 0.01-0.1% SO2, the amount depending on its original concentration in the waste gases. The second step in purification uses the ammonia water-activated carbon method, yielding ammonium sulfate as a by-product and a final concentration of 0.001-0.002% SO2. The proper dispersion of waste gases does not require the building of high chimneys.

5236 APTIC NUMBER 14515

Pretorius, S. T. and W. G. Vandersloot
THE REMOVAL OF AIR POLLUTANTS FROM GASES BY REACTION WITH PARTICULATE SOLIDS. Powder Technol. (Amsterdam), 1(3):129-133, Oct. 1967. 28 refs.

Increasing air pollution control measures in many countries have led to extensive investigations focusing on the removal of sulfur oxides from fuel combustion by reaction with solids in the form of dust, a fluidized bed, or moving bed. Work on the elimination of pollutants with suspended solids has overlooked the fact that the diffusional mass transfer from the bulk of the gas phase to the particle surface is a rate-determining step in flue gas desulfurization. In terms of required reactor length as determined by required contact time, an acceptable mass transfer rate depends on high gas velocities, small particle size, and high particle concentration. Gas velocities in existing installations are mainly in the range 20 to 70 ft/sec, which sets a practical limit to particle fineness. Furthermore, only a limited amount of particles can be carried in the gas stream without deposition. The maximum practical concentration permitted by existing ducts seriously limits efficient pollutant collection with injected dust. Particulates may be used, however, to form fixed or fluidized beds, with high relative velocity between gas and particles, in which the rate determining step is not the diffusion in the gas phase, and in which there are no severe limitations to particle concentration.

5237 APTIC NUMBER 15517

Public Health Service, Washington, D. C., National Air Pollution Control Administration
CONTROL TECHNIQUES FOR SULFUR OXIDE AIR POLLUTANTS. NAPCA Publ. AP-52, 122p., Jan. 1969. 274 refs.

About 75% of sulfur oxide emissions in 1966 resulted from the combustion of sulfur-bearing fuels, with coal combustion accounting for the largest part. The economic and technical aspects of various techniques for controlling these emissions are examined in detail; they are categorized as (1) change-over

to fuels with lower sulfur content or to another energy source, such as hydroelectric or nuclear power; (2) desulfurization of coal or residual fuel oil; (3) removal of sulfur oxides from flue gas by various processes, including limestone-dolomite injection and alkalized alumina sorption; and (4) increase in combustion efficiency. Of the industrial sources of SO2 emissions, nonferrous primary smelting of sulfide-containing metallic ores such as copper, zinc, and lead is the largest emitter. About half of the primary smelters in the U. S. now use sulfuric acid recovery to reduce emissions and at the same time offset smelter operating costs. Smelters, oil refineries, pulp and paper mills, steel plants, sulfuric acid plants, waste disposal processes, and a number of other industrial sources are considered in terms of present technology for reducing emissions. The costs of dispersion of sulfur oxides by tall stacks are briefly discussed as an approach toward reducing the frequency of high concentrations at ground level in some areas, and an extensive bibliography on gas dispersion is included. An appendix on chemical coal processing describes the current state of development of such methods as gasification and liquefaction for reducing the sulfur content of high-sulfur coal.

5238 APTIC NUMBER 15518

Public Health Service, Washington, D. C., National Air Pollution Control Administration
CONTROL TECHNIQUES FOR PARTICULATE AIR POLLUTANTS. NAPCA Publ. AP-51. 215p., Jan. 1969. 807 refs.

This document, issued in accordance with the Clean Air Act of 1967, provides a comprehensive review of the approaches commonly recommended for controlling the sources of particulate air pollution. The many agricultural, commercial, domestic, industrial, and municipal processes and activities that generate particulate air pollutants are described. The various techniques that can be applied to control emissions from these sources are reviewed and compared. A technical consideration of the most important types of gas cleaning devices forms a major segment of the document. Sections on source evaluation, equipment costs and cost-effectiveness analysis, and current research and development are also included. References are appended to each chapter. A bibliography of articles pertaining to pollution control is classified according to specific source categories.

5239 APTIC NUMBER 14955

Babson, S. P.
THE DEVELOPMENT OF AN EXTRACTION PLANT FOR THE ELIMINATION OF BLASTING FUMES. South African Institute of Mining and Metallurgy, Johannesburg, Trans. Seventh Commonwealth Mining and Metall. Conq., vol. 2:759-774, 1961. 20 refs.

Nitrous fumes produce acute toxic effects and, when inhaled in gross concentrations together with siliceous dust, can accelerate the development of silicosis. Methods for extracting the oxides of nitrogen from fumes caused by underground blasting were investigated. A detailed description is given of laboratory work to analyze the composition of fumes released in blasting; the fumes were found to contain nitric oxide, nitrogen dioxide/tetroxide, and nitrogen trioxide, with nitric oxide being the most significant for the problem of fume elimination. Both laboratory extraction tests and underground oxidation tests were carried out; the most successful results were obtained with a combined method of simultaneously oxidizing the nitric oxide and absorbing the oxidation products. An extraction plant was developed, based on the use of alkaline potassium permanganate solution impregnated on vermiculite; the performance of the trial filter showed the effectiveness of a single vermiculite bed, at least 2 ft thick, impregnated with a solution of 5% NaCO3 and 5% KMnO4 in oxidizing and absorbing the nitrous fumes; extraction is good up to 55 f.p.m. Because the bed loses a considerable portion of its absorbing power after extended use, the air should be by-passed during normal ventilation between blasts to reduce decomposition of the permanganate by the air. Despite the good extraction obtained, air from the filter should still be mixed with ventilating air to a dilution of not less than 5 to 1 before supplying the air to working places. The design of a suitable fume extraction plant is described.

5240 APTIC NUMBER 13752

Radushkevich, L. V. and V. A. Kolganov
RATE RELATIONSHIP FOR EFFECTIVENESS OF PRECIPITATION OF AEROSOL PARTICLES ONTO FIBERS AND THE POSSIBILITY OF SEPARATING THE ACTIVE FACTORS IN THE PROCESS OF FILTRATION. (Skorostnaya zavisimost' dlya effektivnosti osazhdeniya aerozol'nykh chastits na voloknakh i vozmozhnost' razdeleniya deystvuyushchikh faktorov v protsesse fil'tratsiiz). Text in Russian. Zh. Fiz. Khim, 42(4):971-976, 1968. 8 refs.

A study is presented of the precipitation of polydispersed polystyrene aerosols having practically spherical particles ranging from 0.1-0.6 microns onto individual fibers with an average diameter of 4.3 microns for flow rates from 0.05-15 cm/sec. Experiments were carried out on a model filter consisting of 186 laminated metallic sections with apertures located in sequence along a duct, forming a cylindrical canal for movement of the aerosol. On each section, polymeric fibers were stretched almost parallel to each other; on each single section there were approximately 500 single fibers, the diameters of which varied from 2-8 microns. At slow rates of flow diffusion, precipitation was inseparably complicated by the effect of contact, and only particles with diameters of 0.1 micron or less were involved in pure diffusion without contact. For faster rates, on the other hand, pure contact without diffusion precipitation was possible, beginning with a rate of about 10-15 cm/sec. Because of the small value of the Stokes number even at increased rates, inertial precipitation can be completely excluded.

5241 APTIC NUMBER 14770

Raman, Anantha K. S.
PROCESS FOR REMOVING SULFUR OXIDES FROM GASES. (Esso Research

and Engineering Co., Linden, N. J.) U. S. Pat 3,458,356. 4p., July 8, 1969. 2 refs. (Appl. July 11, 1966, 6 claims).

Sulfur oxides are removed from waste gases by reacting the gas at a temperature of 750-1000 F with a catalyst-absorbent material. The material may be vanadium trioxide, vanadium tetroxide, or mixtures of these. The corresponding sulfate of vanadium is formed. The spent catalyst-absorbent is regenerated by heating it at elevated temperatures in the presence of sulfur dioxide, yielding sulfur trioxide. Sulfur dioxide is recovered from the flue gases and converted to commercially valuable sulfuric acid.

5282 APTIC NUMBER 14415

Rathgeber, Ferdinand
DUST REMOVAL WITH MATERIAL RECOVERY. (Entstaubung mit Materialrueckgewinnung). Text in German. Wasser, Luft Betrieb, 13(4):117-122, April 1969.

Dust collection by centrifugal force is the most widespread method. Since the efficiency of cyclones increases with decreasing diameter, several cyclones are connected in parallel. One widely used modification of the cyclone is the multiclone, which is composed of a nest of individual cyclones in parallel with a single header and a single dust hopper. Its collection efficiency ranges from 92 to 98% depending on the grain size of the dust. Cloth filters have been in use for eight decades, mainly in form of tubular bag filters. A relatively recent type of bag filter is the self-cleaning reverse jet filter. In this method, the dust is precipitated on the inside of the tubular bags, while in another version of the cloth filter where the tubular bags are encased by a round shell, the dust settles on the outside. Cloth filters may reach collection efficiencies of 99% and more. Another version of the cloth filter is the envelope-type of filter multiple units which are housed together in a metal shell. The dust is removed by either shaking, rapping, or a traveling flushing nozzle. The great advantage of this type of filter is that it saves space. Electrostatic precipitators such as cyclones and cloth filters can be used whenever dust is to be recovered. Recently such precipitators have been developed for use with lower gas quantities, i.e., 8000 to 25,000 cu m/h. Whenever dust is to be recovered, wet collectors should not be used.

5283 APTIC NUMBER 14736

Rathgeber, Ferdinand
DUST REMOVAL FROM WASTE GASES FROM REFUSE INCINERATION. (Entstaubung der Abgase aus der Verbrennung von Abfall und Muell). Text in German. Wasser Luft Betrieb, 13(2):46-50, Feb. 1969. 2 refs.

The two means suitable for cleaning waste gases from refuse incinerators are cyclones and electrostatic precipitators. They must be preceded by some type of waste gas cooling system. For smaller incinerators, fresh air is primarily used for this purpose, while in medium size and large incinerators, the selection is wider. Here, the waste gases can be cooled with cold air, water, or by utilizing the waste heat. Due to stringent laws concerning the control of emissions, cyclones can be used only for smaller incinerators. Electrostatic precipitators with their high collection efficiencies are suitable for installation in any kind of incinerator. Small, compact electrostatic precipitators are available and help save on installation costs. Should it be necessary, mechanical filters can be installed behind electrostatic precipitators to retain charred paper flakes.

5284 APTIC NUMBER 15489

Rees, P. L.
PRESENT PERFORMANCE AND SCOPE FOR IMPROVEMENT IN POWER - STATION FLUE - GAS WASHING EQUIPMENT FOR THE REMOVAL OF SULPHUR DIOXIDE. Institute of Mechanical Engineering, London, Proc. Conf. Mech. Engrs. Contrib. Clean Air, London, 1957, p. 38-41. 16 refs. (Feb. 19-21.)

The methods of removing sulfur dioxide from power-station flue gases were reviewed. The Battersea effluent process used at Battersea and Bankside power stations, removes up to 95% of the sulfur dioxide. The Bowden-I.C.I. cyclic lime process was formerly used at Sir John and Fulham power stations. The Fulham-Simon-Carves process for making ammonium sulfate and sulfur by direct reaction of gas-works ammonia liquor with flue gases is now undergoing pilot plant trials at Nottingham power station. Other ammonia processes that were developed at Trail Smelter are being considered for use in the United States of America by the Tennessee Valley Authority. The removal of pyrites from coal is not generally feasible in Britain because of the very small size of the pyrites aggregates. The dry removal of sulfur dioxide from flue gases, which would not entail the cooling of the gas (a most serious defect of all flue-gas-washing processes because it causes the discharged gas to sink rather than rise), is again being studied, but presents formidable obstacles in engineering and chemical engineering design. (Author abstract modified)

5285 APTIC NUMBER 13892

Picca, Peter Mauro
A STUDY IN THE OXIDATION OF KRAFT BLACK LIQUOR. Thesis (Ph.D.), Florida Univ., Gainesville, Univ. Microfilms, Inc., 1968, 180p. 47 refs.

The oxidation of kraft black liquor with pure oxygen and a mixture of oxygen plus ozone at the temperature range 60 to 90 C was investigated to determine the feasibility of mill scale oxidation using pure oxygen, the fate of sulfur compounds during oxidation, and the possibility of limiting pulp odors with ozone. Physical and chemical parameters examined included temperature, oxidizing agent, oxygen partial pressure, and method of contact. The predominant inorganic reactions that occurred were the oxidation of sodium hydrosulfide to sodium polysulfide and sodium thio sulfate. The thiosulfate reaction was slightly reversible; the polysulfide was not. The mole ratio of polysulfide to thiosulfate

formed by complete oxidation of the hydrosulfide was relatively independent of temperature. Oxidation below 60 C precipitated small quantities of amorphous sulfur droplets from the liquor which, upon aging, crystallized to rhombic sulfur. The optimum oxidation temperature was found to be between 60 and 75 C. Pure oxygen fixed the inorganic sulfides in the black liquor but had little effect on the odorous black-liquor constituents. Exhaust gases were effectively deodorized with 100 to 150 ppm at 25 C of ozone, and it is concluded that the non-condensable gases from evaporates and digesters can be similarly deodorized.

5245 APTIC NUMBER 15922

Risberg, David and Yoash Zolar
PENETRATION OF HIGH EFFICIENCY FILTER PAPER AS A FUNCTION OF PARTICLE SIZE AND VELOCITY. Filtration Separation (Purley), 6(6):723-724, Nov.-Dec. 1969. 9 refs.

A criteria for evaluating the performance of filters is presented. The penetration of particles through high-efficiency H-70 filter paper was measured as a function of particle size and velocity by determining both upstream and downstream particle number concentrations. Test aerosols were monodispersed, polystyrene latex, 0.365, 0.567, 0.796, and 1.099 micron in diameter and consisted of more than 85% single particles. The initial electronic charge on the test aerosol was reduced with a radiation source to an average elemental electronic charge per particle of 0 to 3. Air velocities through the filter were from 0.1 to 5 cm/sec. Penetration values obtained by measurement of the upstream and downstream particle number concentrations for the 0.365 micron particles were confirmed by measurement of the upstream and downstream mass concentrations for a 0.330 micron dioctyl phthalate (DOP) aerosol. This comparison also indicated essentially no difference in penetration for uncharged particles due to the physical state of the aerosol (solid latex vs liquid DOP). (Author abstract modified)

5247 APTIC NUMBER 14613

Rohr, P. H.
SUPPRESSION OF THE STEAM PLUME FROM INCINERATOR STACKS. American Society of Mechanical Engineers New York Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 216-224. 2 refs. (May 5-8).

The use of water scrubber systems for municipal, commercial, and industrial incinerators results in the generation of a supersaturated water vapor which leaves the stack in the form of a visible white plume. The plume reveals the presence of an incinerator which may be capable of inoffensive operation in an urban area, but its continuously identifiable presence can become a standard by which property value is graded. Various methods are possible for the reduction of the moisture content of gases, and therefore, suppression of the steam plume. These methods are: (1) electrostatic precipitation of water droplets from fogged air; (2) mechanical separation of water droplets from fogged air; (3) absorption or adsorption of water vapor; (4) mixing of the moist gases with relatively dry heated air; (5) condensation of the moisture by direct contact with water or on cold surfaces; and (6) reheat of scrubber exhaust gases. An evaluation of systems utilizing these methods indicates that cost of scrubber systems with the means for suppression is related to the lowest ambient air temperatures at which the system is designed to be effective and to the method of dehydration of the flue gases. This preliminary analysis has indicated that the costs of these systems for use at temperatures above 20 F may be comparable to wet scrubber systems in which no provision is made for suppression.

5248 APTIC NUMBER 15327

Rothe, Wilfried, Karl Achenbach, and Guenther Bretschneider
NEW PROCESS FOR DESULFURIZATION OF HYDROCARBONS AND TECHNICAL GASES. (Ein neues Verfahren zum Entschwefeln von Kohlenwasserstoffen und technischen Gasen). Text in German. Erdoel Kohle (Hamburg), 17(5):352-356, May 1964. 37 refs.

A newly developed process for desulfurization of aliphatic, naphthenic, and aromatic hydrocarbons with sodium oxide or sodium hydride is described. Gaseous hydrocarbons are passed over sodium oxide tablets or granules; the best results were achieved with a 1:1 mixture of Na2O and NaCl. The reaction of the sulfur compounds with Na2O follows the equation 2Na2O + RSR yields Na2S + 2NaOR, where R equals an organic radical or H. At the prevailing temperature, NaOR dissociates again with separation of carbon. A theoretical quantity of 124 g Na2O is necessary for binding 32 g of sulfur; otherwise 200 kg of the Na2O-NaCl desulfurizing mixture can bind 25.8 kg sulfur. In experiments with a scaled-down model, 9 to 10 kg S (more than 70% of the theoretical value) were bound per 100 kg desulfurizing mass. In the laboratory, gasolines with various boiling points were evaporated at temperatures from 150 to 200 C and passed over the Na2O-NaCl mass which was heated to 220 C. The results showed that 95 to 99% of the total sulfur could be removed. The successful laboratory results encouraged experiments with a 0.5 ton/day model. Light gasolines with sulfur content of less than 6 ppm and benzenes with sulfur content of less than 5 ppm were used. The theoretical absorption capacity could not be reached, owing to traces of moisture and organic nitrogen and oxygen compounds. The process can also be used for cleaning technical gases such as nitrogen and hydrogen.

5249 APTIC NUMBER 15247

Rottig, Walter
METHOD FOR THE REMOVAL OF SULFUR OXIDES FROM GASES. (Verfahren zur Entfernung Schwefeloxiden aus Gasen). Text in German. (Buhrchemie AG, Oberhausen-Holten, Germany) W. German Pat. 1,262,113. 5p., Feb. 15, 1968. (Appl. March 13, 1962, 2 claims).

A method for removing sulfur oxides from gases uses alkalized magnesium compounds dissolved in aqueous suspension. Magnesium sulfate is formed at the process. The concentration of the magnesium compounds MgO, Mg(OH)2, MgCO3 and Mg(HCO3)2 in the aqueous suspension can range from 10 to 150 g/l. Addition of oxidizing salts and/or gases to the suspension enhances the

reaction. A solution containing just MgSO4 is obtained as end product. Through evaporation pure salt is obtained. Recovery of the suspension for reuse, however, is suggested as the better solution. The sulfate solution is mixed with a stoichiometric amount of ammonia on which the magnesium hydroxide is precipitated. With water a new suspension is obtained which can be used again for removing sulfur oxides. Excess oxygen is always present in the process. From 2- to 10,000-fold of the quantity of SO2 present can be used. Eight practical examples are given. They show that 98 to 99% of the SO2 could be removed by this method.

5250 APTIC NUMBER 15363

ELIMINATION OF SULFUR OXIDES PRESENT IN GASES. (Elimination des oxydes de soufre dans les gaz). Text in French. (Ruhrchemie A.-G., Oberhausen-Holten, Germany) Belgian Pat. 628,092. 16p., Aug. 6, 1963. 3 refs. (Appl. Feb. 6, 1963, 15 claims).

The invention concerns a procedure for removal of sulfur oxides from gas containing them in amounts between 1 and 10,000 g/100 cu m. The gas is scrubbed at temperatures between 100 and 200 C, at pressures between 1 and 100 atm, and at flow rates between 50 and 3000 cu m of gas per cu m of scrubbing liquid per hour. The scrubbing solution consists of aqueous suspensions of MgO, Mg(OH)2, MgCO3, Mg(HCO3)2, or other basic Mg compounds in concentrations between 0.5 and 150 g/l, in the presence of an excess of oxygen provided by additions of oxidizing gases and/or salts to the scrubbing liquid. Scrubbing removes both sulfur oxides, largely in the form of MgSO4, and dust from the gas and can be carried out in one or several stages. The used scrubbing liquid is treated at intervals by gases or liquids containing ammonia in order to transform the MgSO4 into (NH4)2SO4, and the remaining Mg(OH)2 suspension is recycled for scrubbing.

5251 APTIC NUMBER 14765

Pyason, Porter Raymond
METHOD OF REMOVING SULFUR DIOXIDE AND NITROGEN OXIDES FROM GASES. (Chevron Research Co., San Francisco, Calif.) U. S. Pat. 3,454,355. 3p., July 8, 1969. (Appl. May 20, 1966, 6 claims).

A catalytic process for the removal of sulfur dioxide and nitrogen oxides from flue gases is described. The flue gas reacts with a copper, silver, nickel, molybdenum, palladium, or cobalt catalyst on alumina support in the presence of carbon monoxide at 750 F for at least 0.1 sec. The carbon monoxide is at least 75% of the stoichiometric amount necessary to reduce the sulfur dioxide and other oxidizing gases in the mixture.

5252 APTIC NUMBER 15361

Pyason, Porter Raymond
PROCEDURE FOR ELIMINATION OF NOXIOUS CONSTITUENTS OF EXHAUST OR FLUE GASES. (Procede d'elimination des constituants nocifs des gaz d'echappement ou de cheminees). Text in French. (Chevron Research Co., Calif.) French Pat. 1,523,685. 5p., May 3, 1968. 1 ref. (Appl. May 19, 1967, 6 claims).

The invention concerns a procedure for elimination, at elevated temperatures, of SO2 and nitrogen oxides (NOx) present in waste gases containing carbon monoxide in the ratio of at least 0.75, and more commonly 0.9 to 2, molecules of CO for every oxygen atom present in SO2 and NOx. These gases are brought into contact for at least 0.1, and preferably about 0.2 to 0.5 sec at a temperature of at least 400, and preferably about 540 to 650 C, with a catalyst consisting of Cu, Ag, Ni, Mo, Pd, or Co cations adsorbed on an alumina agglomerate in amounts of about 0.2 to 2.0 weight % of the alumina. To convert the metal cation to the elemental state, the dried catalyst may be heated to about 480 to 650 C and maintained in a hydrogen atmosphere at that temperature for 0.5 to 2.0 hrs. The catalyzed reactions: SO2 + 2CO yields 1/2 S2 + 2CO2 and 2NOx + 2x(CO) yields N2 + 2x(CO2) are shown to proceed under the above conditions very nearly to completion.

5253 APTIC NUMBER 14696

Saemundsson, Helgi B.
SEPARATING AIRBORNE OIL DROPLETS BY MEANS OF WIRE-MESH PACKS. (Abscheidung von Oeltropfen aus stroemender Luft mit Drahtgestrickpaketen). Text in German. Verfahrenstechnik, 2(11):480-486, Nov. 1968. 17 refs.

For testing the efficiency of wire mesh packs for the separation of airborne oil droplets, an air flow was produced with a radial blower into which the oil was injected either by pressure atomization or by compressed air atomization. In the former case, the oil was injected with a pressure of 100 bar directly into the air flow, and in the latter case, the oil was atomized with compressed air of 3 bar. With pressure atomization, the collection efficiency was almost 100% and independent of both the lengths of wire mesh packs and the porosity. This efficiency was reached at velocities of 1 and 2 m/sec and can be explained by the fact that the droplets were rather large and were separated in the first layers of the packs. With compressed air atomization, the collection efficiency increased at first with air velocity and dropped again after having reached a maximum as in the case of pressure atomization, but the increase was not as steep, and the maximum was lower. Generally, it can be said that droplets between 25 and 170 microns were separated 100%, and droplets of 3.5 microns were only 70% separated. Comparison with a cyclone shows that wire mesh packs are better suited for separation of small droplets.

5254 APTIC NUMBER 14568

Safiullin, N. Sh. and M. T. Olevinskiy
RENDERING HARMLESS THE WASTE GASES FROM SULFURIC ACID TOWER SYSTEMS. (Obezvrezhivaniye otkhodyashchikh gazov bashennykh sernokislotnykh sistem). Text in Russian. Khim. Prom. (Moscow), no. 3:132-136, 1955.

It is reported that a complex consisting of a precipitation section irrigated with strong acid and a moist electrofilter will assure reliable purification of waste gases from tower systems. Such a system reduces the aerosol and vapor sulfuric acid content to 0.04-0.10 g/cu m, a 20-fold reduction. Complete absorption of an equimolar mixture of nitrogen oxides results in a reduction in specific consumption rate of nitric acid by 6-8 kg/ton. Absorption of nitrogen oxides and reduction of nitric acid discharge rate may be increased significantly by supplying the equipment with nitrogen oxides with a degree of oxidation of 45-50%. In order to assure normal operation of the equipment, the amount of original sulfuric acid circulating in it must be not less than 88%. Joint operation of both the irrigating system and the electrofilter is imperative for proper purification of waste gases.

5255 APTIC NUMBER 13497

Saito, T., F. Shirasaki, and W. Toriyama
STUDIES ON SULFUR IN ACETYLENE GAS GENERATED BY DRY TYPE GENERATORS AND METHOD OF GAS PURIFICATION. Text in Japanese. J.J. Synthetic Organic Chem. (Japan), 27(8):345-351, April 1969. 7 refs.

This study involved the removal of sulfur components from acetylene by washing with dilute sodium hypochlorite. Crude acetylene generated from calcium carbide containing more than 1% calcium sulfide contained a small amount of hydrogen sulfide. Alpha, beta, alpha prime, beta prime-tetrachlorodiethyl sulfide was extracted after purification of the precipitates in the mist separator using a solution of pH 6.5-7.3. Hydrogen sulfide was effectively removed by washing crude acetylene with 10% aqueous NaOH before treatment with sodium hypochlorite.

5256 APTIC NUMBER 15895

Saitoh, Takeshi, Kazuhiko Takaichi, Masakuni Hirata, and Masaaki Hattori
THE POSSIBILITY OF AUTOMOBILE AIR POLLUTION CONTROL BY LOW PRESSURE PETROL INJECTION SYSTEM. (Teiatsu gasorin funsha hoshiki ni yoru haiki kaizen no kanosei). Text in Japanese. Waseda Daigaku Rikogaku Kenkyusho Hokoku (Bull. Sci. Eng. Res. Lab., Waseda Univ.), no. 45:6267, 1969.

The fact that automobile emissions can be controlled by petrole injection is well known. The possibility that manifold gasoline injection at a pressure less than 16 ata can reduce carbon monoxide and hydrocarbon contents in engine exhausts was investigated. Injection systems with one, two, three, and four element pumps and nozzles were used which corresponded to the four cylinder engine. Carbon monoxide and hydrocarbon concentrations were measured in various engine loads and speeds and compared with the carburetor system. The results showed that systems with only one or two elements could reduce carbon monoxide concentrations, but not the hydrocarbon content. Three or four elements in the system were required to reduce both carbon monoxide and hydrocarbon emissions, but this was less than the expected value. (Author abstract modified)

5257 APTIC NUMBER 14630

Schmidt, Alfred and Ferdinand Weinrotter
PROCESS AND EQUIPMENT FOR THE REMOVAL OF NITROUS GASES FROM WASTE GASES. (Verfahren und Vorrichtung zur Entfernung von nitrosen Gasen aus Abgasen). Text in German. (Lentia G.m.b.H., Munich) W. German Pat. 1,075,571. 4p., Feb. 18, 1960. 1 ref. (Appl. May 2, 1958, 7 claims).

A process is described for the removal of nitrous gases from waste gases, primarily from nitric acid factories. These gases are treated with a solution of magnesium nitrite, nitrate, and magnesium hydroxide and carbonate. Magnesium hydroxide and carbonate bind nitrous gases by forming magnesium nitrite. The latter is decomposed by heating to temperatures between 140 and 200 C at 3 to 6 ata according to the equation $3Mg(NO2)2$ plus $2H2O$ yields $Mg(NO3)2$ plus $2Mg(OH)2$ plus 4NO. A scrubbing solution concentration of 200 to 300 g magnesium nitrite/l must be maintained. The solid substance in the solution may not exceed 20%. The NO liberated in the process can be re-used, and the magnesium hydroxide which separates in crystal form can be recirculated. Alkali or alkali earth nitrates are added to the magnesium nitrite solution prior to re-use of the scrubbing solution. The equipment for the process consists of a conventional scrubber, a container heated by pressurized steam for decomposition of the magnesium nitrate lye, a reaction chamber, a chamber for oxidation of NO, and inlet, outlet, and return pipes.

5258 APTIC NUMBER 15270

Schmidt, Karl-Heniz
METHOD FOR REMOVING NITROGEN OXIDES FROM GASES THROUGH CATALYTIC REDUCTION OF THESE SUBSTANCES TO NITROGEN. (Verfahren zur Entfernung von Stickoxyden aus Gasen durch katalytische Reduktion derselben zu Stickstoff). Text in German. Hamburg Gaswerke, G.m.b.H., Hamburg) W. German Pat. 1,259,298. 2p., Jan. 25, 1968. 1 ref. (Appl. Aug. 29, 1964, 2 claims).

A method for removing nitrogen oxides from waste gases, flue gases, etc. involves catalytic reduction of these oxides to nitrogen at high temperatures in the presence of ammonia or compounds which liberate ammonia. Appropriate catalysts are oxides of the sixth to eighth subgroup of the periodic table of elements. Because these catalysts are resistant to sulfur, sulfur-containing gases, primarily flue gases, can be freed of their nitrogen oxides. Chromium and/or iron oxides are particularly effective catalysts. The reaction follows the equation $NO2 + NO + 2NH3$ yields $2N2 + 3H2O$. The reaction temperature can range from 150 to 300 C; about 250 C is preferred for dry gas and above 300 C for very moist gas. The advantages of this method are that (1) any concentration of NO and NO2 is removed completely, even when sulfur is present, (2) no scrubbing process is necessary, (3) no by-product accumulates, and (4) the nitrogen oxides are converted in oxidizing atmosphere. Two practical examples are given. In the first case 250 kg catalyst were used per 300 cu m flue gas/hour.

The dirty gas had a NO content of 120 ml/cu m and a NO2 content of 15 ml/cu m. After catalytic reduction the nitrogen oxides concentrations were less than 0.01 ml/cu m. In the second case the gas contained 3000 ppm which were reduced to less than 0.1 ppm.

5259 APTIC NUMBER 15153

Schoeffmann, Ernst and Willi Schneider
A METHOD FOR ELIMINATION OF DISAGREEABLE ODORS FROM FOOD INDUSTRIES. (Ein Verfahren zur Beseitigung von belaestigenden Geruchsimmissionen aus Lebensmittelbetrieben). Text in German. Staedtehygiene (Uelzen/Hamburg), 20(10):286-288, 1969.

The efforts to deodorize odors emitted by a fish frying plant are described. The plant fried fish in four pans with each containing 80 liters oil. The waste air was initially drawn off and discharged through a chimney 18 m high; the fan had a capacity of 4000 cu m/hr. Since this proved to be insufficient to eliminate odors, deodorizing chemicals with the trade name 'Alamaske' were added to the waste air; thorough mixing neutralized the disagreeable odors. A 1% aqueous solution of the deodorant was injected tangentially into the flow of waste air at a rate of 3 l/hr. The injecting device shuts off operation of the fan as soon as the solution is consumed. Installation and operating costs of this deodorizing device are discussed.

5260 APTIC NUMBER 10730

Schrader, K.
IMPROVEMENT OF THE EFFICIENCY OF ELECTROSTATIC PRECIPITATORS BY INJECTING SO3 INTO THE FLUE GAS. (Verbesserung des Abscheidegrades von Elektroentstaubern durch SO3-Einblasung in die Rauchgase). Text in German. Mitt. Grosskesselbesitzer, 48(6):430-436, Dec. 1968. 4 refs.

Addition of SO3 to the flue gas reduces the high electrical resistance of the dust adhering to the collection electrodes and thus improves collection efficiency. Six experiments were conducted in a power plant using gamma-SO3 with stabilizer to gain more detailed information. The initial fear that the sulfur emissions would increase proved to be unfounded. The evaporated air-diluted SO3 was injected into the flue gas prior to the electrostatic precipitator. In the first experiment, just 5 to 6 ppm of SO3 could be injected. Despite this small amount, the dust concentration in the cleaned gas fell to 2.24 g/cu m, which indicates an improvement of 31.5%. Since the SO3 evaporizer did not function properly, the second experiment was conducted in a boiler furnace with a capacity less than 150 MW. In this experiment, the average improvement in collection efficiency was 72.4%, using SO3 additions from 19 to 22 ppm. Similar good results were obtained in the remaining four tests. In the sixth test, the collection efficiency of the electrostatic precipitator had dropped off sharply after operation for 26,000 hrs. Through addition of SO3, this drop could be reversed. No corrosion problems were encountered.

5261 APTIC NUMBER 15669

Schrader, Richard and Wolfram Vogelsberger
INVESTIGATIONS OF MECHANICALLY ACTIVATED CATALYSTS. IX. MECHANICALLY ACTIVATED IRON OXIDE AS A CONVERSION CATALYST FOR CARBON MONOXIDE. (Untersuchungen von mechanisch aktivierten Kontakten. IX. Mechanisch aktivierte Eisenoxide als Konvertierungskontakte fuer Kohlenmonoxid). Text in German. Z. Anorg. Allgem. Chem., 368(3-6):187-195, 1969. 17 refs.

Magnetite was produced by mechanical chemical reduction of alpha-Fe2O3 in a vibration mill at 250 C in the presence of hydrogen. The magnetite was activated at room temperature in a hydrogen atmosphere in the vibration mill for 1, 3, 5, 10 and 20 hrs. The pulverized magnetite which was obtained as a catalyst for the conversion of carbon monoxide according to the equation CO + H2O yields CO2 + H2. The properties of the catalyst were studied. The gas used for the experiment contained 23.8% CO, the ratio H2O:CO was 2:1, the flow rate of the gas was 2 l/hr, and 10 g catalyst was used. The results showed that the activated magnetite yielded quantities of hydrogen at 350 C which were close to the thermodynamic equilibrium value, while alpha-Fe2O3 showed only slight catalytic activity at this temperature. The catalytic increased gradually with the mechanical activation time. The specific surface of the catalyst likewise increased with activation time; a maximum of 6.3 sq m/g was obtained with an activating time of [illegible] hrs. After that, the surface area decreased again. The roentgenographically determined primary particle size of the magnetite decreased with longer activation times from 86.5 nm at zero hr to 77 nm at 20 hrs, while the lattice distortions increased from 0.05% to 0.91%. The catalytic activity of the magnetite was influenced by the primary particle size (correlation coefficient 0.97), the lattice distortions, and to a lesser extent by the specific surface and the total pore volume. The primary influence, however, was exerted by the activation energy of 20 + or - 1 kcal/mole.

5262 APTIC NUMBER 10371

Schulz, J. F.
FACTORS INVOLVED IN THE DESIGN OF HIGH RISE CHIMNEY AND CHUTE SYSTEMS. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 269-272. 10 refs. (May 5-8).

The design of chimneys and chutes for high-rise construction has become more complex as building heights increase. Such factors as expansion and contraction of the building and chimney, difference in expansion between outside and inside walls, sag of reinforced concrete, and building sway must be considered for effective chimney design. Wind pressure on high-rise buildings affects the internal pressure, and when added to the natural building pressure and the ventilation pressures, can be of a substantial nature. A chimney that is too low will allow products of combustion to enter the building. A tall chimney will avoid this but can create conditions for a wet chimney, which leads to rapid deterioration and to a discharge of dense pollutants at low velocities. The paper lists ten practices to reduce wet

chimney problems. Also given are a number of recommendations regarding design of refuse chute and incinerator systems for building up to ten stories, and recommended chimney installation when a draft inducer is not required, as well as when a draft inducer is required because of a gas washer.

5263

APTIC NUMBER 15152

Schwanecke, Rudolf
WASTE GAS CLEANING THROUGH COMBUSTION OF NITROGEN OXIDES. (Abgasreinigung durch Verbrennen von Stickstoffoxyden). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(9):262-268, 1969. 3 refs.

Various methods for elimination of NO and NO2 from waste gases are reviewed. Absorption of the nitrogen oxides on silica gel has recently interested the nitric acid plants. Water vapor is used for desorption, and the recovered nitrogen oxides are returned to the nitric acid plant. If no recovery of the nitrogen oxides is desired, they can be removed from waste air by scrubbing with water or bases such as sodium hydroxide or ammonia water. The reaction follows the equation 3NO2 + H2O yields 2HNO3 + NO. As can be seen, only NO2 is removed. A patented process for dissociation of NO and NO2 in the reducing part of the flame is based on the reaction of carbon monoxide with NO2 and NO in a flame sustained in an atmosphere of low air. The reaction follows the equation 2NO + 2CO yields N2 + 2CO2. It has also been discovered that the nitrogen oxides dissociate in an atmosphere of 20% or more excess air. The process depends on the thorough mixing of the gases with the flame, as accomplished by atomization. In a chemical plant, NO and NO2 are eliminated by a combination of scrubbing and combustion. Nitric oxide escapes from the scrubber at a rate of up to 30 cu m/hr with a temperature of 30 C. It is mixed with air and atomized with the fuel oil in a muffle furnace; it serves as combustion air and as an atomizing agent for the fuel oil. About 3 to 5 ppm of NO and NO2 were measured in the waste gas of the furnace.

5264

APTIC NUMBER 16586

Schwarz, O.
GENERAL VIEWPOINTS AND WORK BY THE HARD COAL MINING ENGINEERS ASSOCIATION ON DESULFURIZATION OF FLUE GASES. (Allgemeine Gesichtspunkte und Arbeiten des Steinkohlenbergbauvereins zur Schwefelabscheidung aus Rauchgasen). Text in German. Mitt. Ver. Grosskesselbesitzer, vol. 83:67-71, April 1963. 6 refs.

Hard coal contains sulfur in the form of organic sulfur (57%), pyrite (41%), and sulfate (2%). Of the hard coal mined in the Federal Republic of Germany, 93% is high-quality coal which can be sold, and 7% is ballast. The average sulfur content of all the coal mined in Germany amounts to 0.0148 kg/10,000 kcal. About 40% of the high-quality coal is used for coking, and 15 to 20% is exported. On the whole, it can be said that about 50% of the mined coal goes into combustion processes in which the sulfur is liberated and emitted to the atmosphere. Thus, out of the 140 million tons of coal mined annually, 705,000 tons of sulfur, 1,400,000 tons of SO2, 1,763,000 tons of SO3 and 2,155,000 tons of H2SO4 are emitted. Not all sulfur emissions qualify for desulfurization processes. Thus, the sulfur which can be gained from desulfurization is less than the amount emitted and is estimated as about 302,000 tons. The Federal Republic of Germany only has a market for sulfuric acid, which means that any desulfurization process has to take this into account. The Mining Engineers' Association presently operates experimental equipment with which problems such as the suitability of dry desulfurization for flue gases from coal-fired furnaces are being studied. The results are encouraging, but the equipment needs further development in order to be used in industry.

5265

APTIC NUMBER 15532

Shale, C. C., W. S. Howie, J. M. Holden, and G. R. Strimbeck
CHARACTERISTICS OF POSITIVE CORONA FOR ELECTRICAL PRECIPITATION AT HIGH TEMPERATURES AND PRESSURES. Bureau of Mines, Morgantown, W. Va., Morgantown Coal Research Center, RI 6397, 16p., 1964. 20 refs.

The Bureau of Mines is studying the feasibility of electrical precipitation for removing entrained solids from gases at high temperatures and pressures: this method, if applied to new processes, could open new markets for coal. However, the highest known combination of temperature and pressure for which commercial equipment is available is 600 F and 2 atm. Consequently, a bench-scale precipitator was used to study the characteristics of positive corona for precipitation under unusual conditions of temperature and pressures. Electrical characteristics of positive corona are presented for air in a 2-inch-diameter electrostatic precipitator operating under dynamic conditions at 600 to 1500 F and 0 to 80 psig. Results show that current-voltage relationships depend solely on air density. Comparison of data on positive corona with previously published data on negative corona demonstrates a higher sparkover voltage and a wider range of operability for positive corona at temperatures above 375 F. The possibility of achieving higher voltages with positive polarity as indicated by these experiments implies several advantages for the use of positive corona in precipitators to allow better removal of suspended material from hot gases. Based on the physics of an ion in an electrical field, a theoretical equation is derived to define current-voltage characteristics of positive corona in terms of air density. Constants for the equation are evaluated from test data. Calculated current-voltage values at different air densities agree reasonably well with experimental data.

5266

APTIC NUMBER 15543

Shale, C. C. and G. E. Pasching
OPERATING CHARACTERISTICS OF A HIGH-TEMPERATURE ELECTROSTATIC PRECIPITATOR. Bureau of Mines, Morgantown, W. Va., Morgantown Coal Research Center, RI 7276, 19p., July 1969. 19 refs.
CFSTI: PB 185589

A pilot-scale semicommercial high-temperature precipitator and adjunct equipment for removing solids from coal process gases are described, and operating characteristics at 1470 F and 80 psig are presented for both positive and negative polarity. The high-temperature electrical characteristics of negative corona in a bundle of 6-inch tubes are shown to be similar to those found previously for a single 2-inch tube. Although the negative electrical field in a precipitator almost completely deteriorates at high temperature and low density, high gas density provides an adequate field to accomplish effective gas cleanup in a precipitator at this temperature. Dust removal efficiency in the negative corona ranges 93-96% at maximum tolerable voltage (36.5 kv) prior to sparking; power input averages 6.4 kva. Removal efficiency in the positive corona is only 75-77% even at 54 kv is almost 50% higher than the maximum utilized in the negative corona; power input is less than 2.0 kva. Input power-removal efficiency relationships at high temperature compare favorably with those found in industrial precipitators operating at much lower temperatures. Voltages well above the maximum utilized might be used at these operating conditions to improve the relative effectiveness of positive corona for cleaning ash laden gases. The use of positive polarity in a precipitator for cleaning hot gases appears to be limited to the voltage at which localized flares are generated under given operating conditions. No apparent insurmountable problems were encountered in operating the electrostatic precipitator at 1470 F and 80 psig. Thermal misalignement of the tube sheet in addition to difficulties with the yoke and the tube rapper, appear to be mechanical problems that can be eliminated by design modifications.

5267 APTIC NUMBER 14623

METHOD FOR THE REMOVAL OF SULFUR DIOXIDE FROM GAS MIXTURES AND THE ACCEPTORS FOR THIS PROCESS. (Werkwijze voor het verwijderen van zwaveldioxyde uit gasmengsels alsmede acceptoren hiervoor). Text in Dutch. (Shell International Res. Co., The Hague) Dutch Pat. 6,810,671. 12p., March 15, 1966. (Appl. Sept. 18, 1968, 19 claims).

The invention relates to a method for removal of SO2 from oxygen-containing gas mixtures above 300 C using a fixed acceptor containing copper oxide. The fixed mantel material can be alumina, silica, silica-alumina and/or silica-magnesium and should have a surface area of at least 100 sq m/g. The acceptor should contain 0.1 to 10% by wt of chromium oxide and/or 0.1 to 2% by wt barium oxide as promoters and must be impregnated with a copper salt solution. The impregnated mantel material is dried and calcined. The saturated acceptor is removed continuously from the reaction chamber where SO2 is removed from the gas and is fed to the second chamber, where it comes into contact with a reducing gas at 350-450 C. The acceptor is then re-circulated to the first reaction chamber.

5268 APTIC NUMBER 14488

Shoji, H., K. Nishida, T. Denda, Y. Koyama, and T. Ando
REMOVAL OF OFFENSIVE COMPONENTS BY THE DEODORIZER. (Dasshu zai ni yoru aku shu seibun no tokyo koka ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):83, April 1969.

The efficiency of an easily-used spray deodorizer comprising vegetable oil, perfume, and surfactant was determined in an experimental deodorizing chamber. A spray of 50 to 100 g/min removed 50 to 91.2% of ammonia (45 to 100 ppm) at a flow rate of 2.2 to 5.6 cu m/min. A spray of 20 to 60 g/min removed 60 to 89.7% of hydrogen sulfide (125 to 250 ppm) at a flow rate of 2.0 to 2.4 cu m/min. Measurements of the deodorizer's ability to counteract odors in sealed cars transporting human excretion show a 58.1 to 93.5% removal efficiency for methyl mercaptan and diethyl sulfide. Only 9.1% removal efficiency was obtained for di-n-propylamine. These measurements suggest that the deodorizer not only neutralizes malodorants but also effects some occlusion of components.

5269 APTIC NUMBER 15148

Siegmund C. W. and F. W. Manny
QUALITY CHANGES OF THE FUEL OIL AT MORE STRINGENT LIMITATION OF THE SULFUR CONTENT. (Qualitaetsveraenderungen bei Reinzeleinfluss der Schwefelauflagen). Text in German. Oel Gasfeuerung, 14(9):874-82, 1969. 3 refs.

Limitations on sulfur oxides emissions primarily apply to power plants which emit 52% of the total sulfur oxides emissions. These emissions can be reduced either by the use of low-sulfur fuel or desulfurization of the waste gases. Low-sulfur fuels are obtained either from crude oil with low sulfur content or by desulfurization of high-sulfur crude oil. The low-sulfur crude oil contains paraffin which solidifies between 38 and 40 C so that a temperature of 50 to 55 C must be maintained to guarantee smooth flow through the pipe system of furnaces. If this high temperature cannot be maintained at all times, distillate fuel oil must be added. In this way, the viscosity and density of the fuel oil is decreased. As a consequence, lower preheating temperatures are required without impairing the atomization process. The main advantage of low-sulfur fuel oil is the low content of ash-forming substances and asphalt. Distillate fuel oil is practically ash free. Two methods are available for desulfurization of high-sulfur fuel oil, namely, catalysis and vacuum desulfurization. Selection of the method depends on the properties of the high-sulfur crude oil. Present regulations in New Jersey and New York require desulfurization to a residual sulfur content of 0.3%. In California, sulfur content is limited to 0.5% by weight. In general, the quality of low-sulfur fuel oil is better, though the costs are higher owing to the necessary desulfurization process. For desulfurization of emissions, alkaline additives or oxidation of SO2 to SO3 and conversion to sulfuric acid can be used.

5270 APTIC NUMBER 14599

IMPROVEMENTS IN OR RELATING TO A PROCESS FOR SEPARATING A CONSTITUENT FROM A STREAM OF MEDIA. (Siemens-Schuckertwerke A. G., Erlangen, West Germany) Brit. Pat. 1,003,419. 8p., Sept. 2, 1965. (Appl. May 21, 1962, 15 claims).

A process for separating a constituent from a stream of gas is described. The reagent used, e.g., ferric oxide, must form at least one product with at least one constituent of the gaseous medium which product has a greater specific gravity than the other gaseous constituents. The potential flow is introduced axially into an annular region adjacent to the inner surface of a chamber. The potential flow is stimulated by stirring devices which rotate about the axis of the chamber and/or angular injection of a second medium into the chamber. The potential flow has an axial component of velocity directed oppositely to the direction of flow of the gas stream and an angular component of velocity. By the action of a rough ground (a point in the flow at which the axial component of velocity of the potential flow is reduced to zero) upon the potential flow, a rotary flow is set up which has an angular component of velocity in the same direction as the angular component of velocity of the potential flow, and has an axial component of velocity in the same direction as the direction of flow of the stream. The process is such that the constituent of greatest specific gravity is collected in an annular zone and is discharged with an axial component of velocity in the opposite direction to the direction of flow of the stream.

5271 APTIC NUMBER 18716

Simonin, J. C.
FIGHTING AIR POLLUTION BY BOILER PLANTS. (Lutte contre la pollution atmospherique par les fumees des chaudrieres). Text in French. Chaleur Ind., no. 438:251-266, Sept. 1961. 9 refs.

A general review of air pollution control methods for combustion gases and particulates is presented. Sulfur dioxide emissions from well-regulated boilers presents the greatest control problem. Fuel desulfurization is practical only for natural gas, and not for heavy oils or coal. Removal of SO2 after combustion involves washing, which cools the gas and may seriously impair dispersion of the remaining fumes. Lime, chalk, or ammonia added to the scrubbing water yields recoverable by-products. Over half the atmospheric SO2 is emitted by boilers too small to practice economic extraction of sulfur products. Properly-run gas and oil burners emit little dust. Oil does produce carbon particles of 0.01 micron diameter, which are difficult to remove. Centrifugal cyclone extraction is efficient for particles larger than 30 microns. Electrostatic precipitation can be 99% efficient and cheaply performed. Water separators which trap the dust in fog nuclei are useful for fine particles, although they cool the gas. Artificial fiber filters are recommended for this application. Correct chimney height and gas exit velocity are important for adequate dispersion. Addition of an exit nozzle to an existing chimney can increase the gas velocity without increasing pressure simultaneously.

5272 APTIC NUMBER 18445

Singhal, R. K.
DUST COLLECTION AND GAS CLEANING IN MINERAL INDUSTRIES. Australian Mining, 60(6):50-61, June 15, 1968.

The various methods of controlling dust in mineral industries are discussed. Electrostatic precipitators are regarded as the best means of providing high efficiency removal of dust or liquid droplets from air, gas, or vapor streams. Wet or dry gases can be treated by electrostatic precipitators. With dry gases, the dust is removed from the collecting electrodes by a mechanical shock to the plates. With wet gases, continuous irrigation or intermittent spray washing may be used. Centrifugal collectors use centrifugal force to separate dust from the gas stream. They may be large-diameter cyclone units, or the more common multiple cyclone type. In both cases, the rotary motion of the gas imparts a force to the particles which separates them from the gas. Wet collectors operate by bringing the dust-laden gas in contact with a water film or spray. They may involve cyclones, high pressure drop venturis, or multiple sprays. Filters may also be used to remove dusts from a gas stream. Important factors to be considered when selecting gas cleaning equipment are the gas volume to be handled and the temperature at which the equipment will operate. Physical characteristics of the dust which will affect collector operation are the particle size, specific gravity, and dust concentration.

5273 APTIC NUMBER 18706

Smolik, J.
DUST SEPARATION PROBLEMS AT INDUSTRIAL SOURCES OF AIR POLLUTION IN CZECHOSLOVAKIA. (Odlucovani prachu z prumyslovych zdroju exhalatu v CSSR). Text in Czech. Ochrana Ovzdusi, no. 4: 49-51, 1969.

The growth of industry in Czechoslovakia has been accompanied by an increase in the emission of finely dispersed and highly concentrated impurities. Despite the application of expensive dust separation equipment designed to suppress emissions at their source, reduction of air pollution is still a problem. All categories of collectors, including cyclones, electrostatic precipitators, wet collectors, and filters, are subject to failures caused by clogging, erosion, or corrosion. Future criteria for collectors must be based on systemized observations and standard measurements at all important air pollution sources. There are examples of unsatisfactory operation of collectors affected by the quality of material, precision of product, or assemblage, e.g., the breaking of high-tension electrodes of electrostatic precipitators and leaks in hoppers. Since many defects are not immediately apparent, means for quality control at the source of production must be considered. However, collectors can be even more adversely affected by the industrial processes causing pollution. Optimal collector conditions depend on the control of these processes. Further improvement of collector efficiency also depends on increased reliability of critical collector components.

5274 APTIC NUMBER 18396

Smyslov, V. I.
MEANS OF ELIMINATING HARMFUL WASTES FROM SULFURIC ACID TOWERS. (Puti likvidatsii vrednykh vybrosov bashennykh sernokislotnykh

sistem). Text in Russian. Ochistka Ispol'z. Stochn. Vod Prom. Vybrosov, Kiev, Sb., 1968:88-93.

Various causes of instability in tower operation, and hence increases in the amount of harmful wastes above permissible levels together with a decrease in productivity, are discussed in general terms. Measures adopted in 1958 to normalize operating conditions and limit each plant to operation with a single raw material type were only partially implemented but did yield positive results; by 1962, the average consumption of nitrogen oxides per ton of products for all plants had been reduced from 28 kg (1958) to 20 kg; leading plants reduced HNO3 consumption to as low as 10 kg. The so-called cross-reflux scheme has recently been proven effective and is recommended for adoption. Conversion to a combined contact-tower system at the Odessa plant has been completed; it can be applied to plants operating with pure sulfur or pyrite. It is concluded that sufficient means are available for improving sulfuric acid systems and for eliminating harmful wastes; accelerated implementation is urged.

5275 APTIC NUMBER 15378

PROCEDURE FOR PURIFICATION OF COMBUSTION GASES. (Procede pour l'epuration des gaz de combustion). Text in French. (Societe des Forges et Chantiers de la Mediterranee, France) French Pat. 1,399,787. 3p., May 21, 1965. (Appl. April 10, 1964, 2 claims).

The invention concerns a procedure for purification of combustion gases, particularly of coal- or fuel oil-fired boilers, by means of a heat exchanger made of granulated material and placed in the combustion gas duct. The granulated material may itself contain substances which react with SO2 and SO3 contained in the combustion gas. Such as red bauxite slurry after hardening, or it may be in the form of an inert porous substance which adsorbs SO2 and SO3, such as kieselguhr. The surface of the grains of this material removes the film of acid formed by the reaction of SO2 and SO3 with water when the combustion gas temperature has been lowered sufficiently.

5276 APTIC NUMBER 15391

Spaite, Paul W. and Robert P. Hangebrauck
ENVIRONMENTAL QUALITY THROUGH RESPONSIBLE RESOURCE MANAGEMENT. Preprint, Canadian Society of Chemical Engineers, Edmonton, Alberta, 11p., 1969. 8 refs. (Presented at the Canadian Chemical Engineering Conference, 19th, Edmonton, Alberta, Oct 19-22, 1969.)

Sulfur dioxide pollution from power plants using coal represents a major segment of the total air pollution problem, requiring the development and use of both short-term and long-term applications. Remote siting of power plants with tall stacks appears to become less effective as plant capacities grow. Other aspects of siting, such as location of plants near low-sulfur western coal reserves and use of advanced lower-cost power transmission may have more impact. Although naturally occurring sulfur coal and 'cleaned' coal may provide a means for minimizing pollution, especially in some areas, their use is limited. Increased use of desulfurized residual oil and natural gas becomes uneconomical, in addition to a shortage of supply. Processes for removal of sulfur dioxide from power plant flue gas have so far been uneconomical; thus research is being conducted on a variety of process types that are capable of application to different segments of the total problem, such as limestone-based processes (dry injection and wet line scrubbers). Programs have also been developed for coal gasification or conversion to clean fuels.

5277 APTIC NUMBER 15276

Speransky, Postislav
HEAT UTILIZATION AND RECOVERY OF SO2 FROM WASTE GASES OR GAS STEAM MIXTURES. (Nutzbarmachung der Waerme und Gewinnung von Schwefeldioxyd aus Abgasen bzw. Gasdampfgemischen). Text in German. (Assignee not given.) F. German Pat. 1,5276. 5p., Sept. 24, 1958. (Appl. Feb. 7, 1956, 3 claims).

A method is presented for recovering SO2 and heat from waste gases while simultaneously removing dust. A vacuum dust separator and air turbine are installed between a gas turbine and heat exchanger and a chemical reactor is installed between the heat exchanger and compressor. The gas turbine and dust separator may be combined in one unit. The cleaned waste gas or gas steam mixture passes through an air turbine, where the kinetic energy is utilized, and on to the heat exchanger. The inlet temperature of the heat exchanger is kept above the dew point to avoid corrosion. The heat exchanger cools and precipitates the water vapor fraction of the waste gas. The condensate can be used as boiler supply water. The waste gas is now 100% saturated and goes to the chemical reactor consisting of several by-product coke filters. Here the entire SO2 and SO3 fractions are adsorbed. For desorption hot air is used. The gas mixture obtained at desorption consists of SO2, negligible amounts of SO3, O, N, and CO2; it can be used for technical purposes. Waste gas that has been utilized is free from impurities when emitted into the atmosphere.

5278 APTIC NUMBER 15239

Speransky, Posislav
METHOD FOR CLEANING WASTE GASES AND THE REMOVAL OF NOXIOUS SUBSTANCES. (Verfahren zur Reinigung von Abrauchgasen und Abscheidung von schaedlichen Stoffen). Text in German. (Rudolf Boehm, Horst Voigt, Postislav Speransky, Emerich Markus, Erich Krawiki, Karl Hartung, Hans Soost, Heinrich Gierden, and Kurt Kappaun, Berlin). F. German Pat. 20,456. 3p., Dec. 9, 1960. (Appl. Aug. 3, 1956, 1 claim).

A method for cleaning waste gases and separating noxious gas and tar was devised. The waste gas is conducted through a cooling system where it is cooled to 20-25 C. The cooling water is not polluted in this process by SO2, SO3, tar, or phenols. The scrubbing water which accumulates in condensed form can be easily cleaned. The cooled waste gas then goes to an acoustic

separator where the tar is separated and then to a filter with coke which adsorbs the SO2 and SO3 fractions. The filter is regenerated, and the SO2 and SO3 are recovered and used as raw materials.

5279 APTIC NUMBER 10669

Speransky
THE POSSIBILITY FOR THE USE OF ACOUSTIC AND ADSORPTION FILTERS FOR CLEANING WASTE GASES. (Die Moeglichkeit des Einsatzes von Schall und Adsorptionsfiltern zur Reinigung der Abgase). Text in German. Energietechnik, 8(11):509-510, Nov. 1958.

The history of acoustic and adsorption filters for use in air pollution control is reviewed. The first acoustic filter for separation of fine dusts was patented in 1886 and consisted of several freely suspended gongs. Until the 1930s when sirens were introduced, no new developments appeared. It was found that best results were achieved with frequencies from 1 to 5 kHz and an acoustical intensity of 0.1 W/sq cm. In 1954, a British journal discussed the possibility of developing a sound source operated by a waste gas in such a manner that it produces the sound itself. The idea has been realized in the power plant Klingenberg in connection with a centrifuge. The collection efficiency of the centrifuge was improved by 1 to 3%. Adsorption filters mainly came into use after 1945. To explain the functioning of an adsorption filter cleaning system, a practical example is given. Waste gases containing SO2 and tar particles were first cooled and passed through an acoustic filter for removal of the tar particles. Next, the gas was passed over a stationary layer of non-activated Koppers coke. The Koppers coke was used several times and recovered with hot air at 240 to 260 C.

5280 APTIC NUMBER 15738

Squires, Arthur M.
CONTROL OF SULFUR DIOXIDE IN THE EXHAUST GASES FROM THERMOELECTRIC PLANTS. (Il controllo dell'anidride solforosa negli scarichi gassosi della centrali termoelettriche). Text in Italian. Acqua Ind., 9(52):13-15, 17-23, 1967.

Construction of nuclear power plants will not provide immediate relief from the problem of controlling sulfur emissions from conventional plants, since construction of high-efficiency plants cannot begin until about 1985. Use of coal and hydrocarbon fuel oils naturally low in sulfur is impractical due to inadequate supplies of these materials. Desulfurizing fuel oil to 1% content costs about 25 cents per million calories, not allowing for profits from sale of by-products. Six desulfurizing plants in Japan will have a combined output of 187,500 barrels/day. The Japanese goal is to reduce sulfur content to 1.7% by 1969 and later to 1.1%. The most satisfactory coal desulfurization process is sifting to remove pyrite particles. Semicoke is partially desulfurized with hydrogen, the H2S being trapped by an acceptor such as MnO2, lime, or dolomite, from which SO2 is then removed as a gas. Reduction from 3% to 0.3% sulfur is estimated to cost 10 cents/ton or 1-1/2 cents/million calories. Recovered sulfur is worth 57 cents per ton of semicoke treated. However, large power plants might find exhaust-treatment methods more economical.

5281 APTIC NUMBER 15288

Squires, Arthur M., Robert A. Graff, and Melvyn Pell
DESULFURIZATION OF FUELS WITH CALCINED DOLOMITE. I. INTRODUCTION AND FIRST KINETIC RESULTS. Preprint, American Institute of Chemical Engineers, New York, N. Y., 27p., 1969. 32 refs. (Presented at the Am. Inst. Chem. Engrs. Annual Meeting, 62nd, Washington, D. C. 1969, Paper 12C)

Gasification with air and carbonization or cracking serve to release sulfur from fuels in the form of H2S. Both fully-calcined and half-calcined dolomite have the power to accept sulfur from H2S according to the reactions (1) (CaO + MgO) + H2S equal (CaS + MgO) + H2O and (2) (CaCO3 + MgO) + H2S equal (CaS + MgO) + H2O + CO2; (3) is the reverse of reaction (2) to regenerate half-calcined dolomite and obtain H2S in concentrated form. The thermodynamic conditions of temperature and pressure of each reaction are discussed. To illustrate the technical possibilities, a representative clean power system for treating coal and producing by-product sulfur is described, in which a unitary operation can carbonize coal and desulfurize the products by the action of hydrogen and a solid acceptor for sulfur. The fuel-processing vessel operates at 21 atm and houses three fluidized-solids zones: a 'hydrocarbonizing' zone at 760 C, which converts finely ground coal into gaseous products and coke pellets; a desulfurizing zone also at 760 C, for removing sulfur both from gaseous products of carbonization and from coke by the action of H2 at 5.8 atm and calcined dolomite acting as a sulfur acceptor; and a calcination zone at about 950 C, for decomposing CaCO3. Each of these zones is described. Several advantages of the system are given: hydrocarbonization and desulfurization occur nearly simultaneously; H2 arises autogenously, and a separate H2 facility is therefore not needed; a single processing vessel can handle an outstandingly large throughput of coal; thermal efficiency of the operation is high enough to avoid any loss in power generating efficiency, and the coke pellets are ideal for fluidized-bed combustion by two current techniques. First kinetic results for reaction (1) above, conducted on spheres 5 to 8 mm in diameter are discussed, and a reactor for obtaining differential rate data by following the change in weight of a sample of dolomite stone is described.

5282 APTIC NUMBER 15240

Squires, Arthur M.
SYSTEM TO PROVIDE CLEAN POWER FROM RESIDUAL OIL. Preprint, Air Pollution Control Association, New York City, 30p., 1969. 18 refs. (Presented at the Air Pollution Control Assoc., Annual Meeting, 62nd, New York, June 1969, Paper 69-198.)

If the power industry should gear itself to accept the oil refiner's high-sulfur discards, the premium cost for low-sulfur oils to the small non-power user might be reduced by more than 40%. A plant is described to treat high-sulfur oils at an existing power station and to supply the station with sulfur-free

fuels. The plant includes oil cracking, oil gasification, and product desulfurization steps. The latter step employs calcined dolomite, and sulfur is recovered for sale in its elemental form. Nearly half of the fuel products are liquid or solid and can be stored. For a customer station having a load factor of 70%, the station could be turned down to 37% of its rating before the clean fuel plant need be cut back. The scheme is nearly a break-even proposition from the energy standpoint, and there is a good possibility that its adoption could reduce the cost of electricity below present level. (Author abstract)

5283 APTIC NUMBER 18524

Stabenow, C.
PERFORMANCE AND DESIGN DATA FOR LARGE EUROPEAN REFUSE INCINERATORS WITH HEAT RECOVERY. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 278-286. 8 refs. (May 5-8).

In Europe, where the demand for better air pollution control and shortage of landfill areas became acute at an earlier stage, efficient incinerator design is more advanced than in the United States. Now that the solid waste disposal problem requires immediate attention in this country also, a study of European design data is in order. Considering that European furnaces have been successfully subjected to all types of refuse, including industrial waste with exceedingly high heating values and refuse with high moisture and ash contents, there is reason to believe that similar equipment will perform equally well in the United States. The apparent trend in Europe is toward large municipal incinerator stations where raw refuse is fed to combustion chambers with a guaranteed burnout rate. Furnace walls are cooled with water and available heat is recovered and utilized for power or heat generation. The residue consisting of ashes and other nonburnable materials occupies only 6% of the original volume of refuse fed to the furnace. Design improvements that have taken place in the past few years are reflected in the design specification presented in this article. These specifications should help municipal authorities and consulting engineers select a design that will do better than barely meet new standards for soil, air, and water pollution.

5284 APTIC NUMBER 13987

Stacy, W. O., F. J. Vastola, and P. L. Walker, Jr.
INTERACTION OF SULFUR DIOXIDE WITH ACTIVE CARBON. Carbon, 6(6):917-923, Dec. 1968. 12 refs.

The interaction of SO2 with a well-outgassed active carbon surface was studied over the temperature range 50-650 C. Sulfur dioxide (0.5 volume %) in He was passed through a packed bed of carbon, the outlet gas stream being monitored by a thermal conductivity cell and a mass spectrometer. Chemisorption of SO2, and/or its dissociation products, between 50 and 300 C was small, amounting to about 1% of the total surface area. Essentially complete regeneration of the carbon could be achieved by heating at 950 C in flowing He. At 650 C, SO2 reacted with the carbon rapidly forming CO, CO2, and elemental sulfur. Significant amounts of the sulfur left the bed and deposited in cooler parts of the reactor. Under these conditions, active carbon is most efficient at removing SO2. (Author summary modified)

5285 APTIC NUMBER 18472

Staubing, Peter
DIFFERENCES BETWEEN MECHANICAL AND ELECTRICAL FILTRATION OF AIR. (Unterschiede zwischen Luftfilterung auf mechanischem und elektrischem Wege). Text in German. Wasser Luft Betrieb, 13(8):289-291, 1969.

Solid or liquid pollutants contained in the air are retained in mechanically operating filter media by sifting sedimentation, diffusion, blocking, or inertia. Filters based on the inertia effect of particles are of major importance. Because of their greater mass, these particles cannot follow the air flow and are precipitated in the filter. The collection efficiency of these filters increases with increasing particle mass and speed. Filters based on the diffusion effect are also used frequently. Sufficiently small particles are subject to Brownian movement and are therefore precipitated from the air flow. Collection efficiency of these filters increases with decreasing particle size and decreasing speed. There are mechanical filters for collection of coarse particles (10 microns and more) which can be of fiber or wetted metal. The dirty gas usually enters at speeds between 1 and 2 m/sec. The pressure loss is less than 10 kg/sq m. Mechanical filters for precipitation of fine dust particles are almost exclusively made of inorganic natural or synthetic organic fine fibers. They can usually not be reused, since repeated cleaning destroys the fiber material. Moreover, the fine dusts are difficult to remove from these filters. Mechanical filters for precipitation of suspended matter are designed to retain particles of less than 1 micron. These filters are sensitive to moisture (particularly cellulose-asbestos filters) and can be used at relative humidities of less than 85 to 90%. Of the numerous electrostatic precipitators, the one operating according to the Penny system is discussed.

5286 APTIC NUMBER 18558

Stezhenskiy, A. Y. and V. S. Luk'yanchikov
NITRIC OXIDE FORMATION IN GAS TURBINES. (Ob obrazovanii okisi azota v kamerakh sgoraniya gtu). Text in Russian. Fiz. Goreniya, Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb., 1966:91-94. 5 refs.

It is estimated that existing gas turbines discharge 3 kg of NO2 per ton of natural gas consumed, or 720 tons of NO2 per 1000 kW of useful power per year. The NO concentration in gas turbine exhaust reaches 0.2 vol %. Calculations indicate that cooling of the exhaust gases with secondary air at a rate of 1000 deg/sec will assure almost complete dissociation of NO to N2 and O2.

5287

APTIC NUMBER 14730

Stites, J. G., Jr., W. P. Horlacher, Jr., J. L. Bachofer, Jr., and J. S. Hartman
SO2 CONVERSION. 3. REMOVING SO2 FROM FLUE GAS. Chem. Eng. Progr., 65(10):78-79, Oct. 1969.

A prototype plant to demonstrate the technical feasibility of a catalytic oxidation system for removing sulfur dioxide from flue gas, opened in 1967, using commercial-type equipment designed to treat 28,000 std cu ft/min; the system permits cleaning the catalyst from the converter beds without converter shutdown. All fly ash is effectively removed from the hot furnace gas with the combination mechanical separator and electrostatic precipitators. The operability of the dust collection system is outstanding; however, experience indicates that use of the less expensive pneumatic system would be satisfactory. The converter system provides conversions of SO2 to SO3 in excess of 90% as long as the proper temperature is maintained; conversion efficiency of 80% can still be achieved at 750 F. The flue gas, after enrichment with SO3, is cooled to just above the dew point in a two-step system involving first a high-level economizer and then a Ljungstrom air preheater. Over 99.5% of the very fine sulfuric acid mist particles are formed in the process of cooling SO3-enriched gas streams removed with a mist eliminator. The prototype CAT-OX unit is operated at a negative pressure. Motive force for the flue gas is an induced draft fan following the eliminator. Instrumentation, operations, maintenance, and economic considerations are briefly discussed.

5288

APTIC NUMBER 14703

Storch, O.
THE EXISTING EQUIPMENTS WITH DRY AND WET SEPARATORS IN METALLURGICAL WORKS. (Dosavadni zkusenosti se suchymi a mokrymi aerosmechanickymi odlucovaci v hutich). Text in Czech. Ochrana Ovzdusi, no. 4:60-63, 1969. 4 refs.

Aerosmechanical and wet separators are considered in terms of their dust collecting efficiencies for metallurgical and technological processes involving the use of oxygen. Previous dry aerosmechanical separators had relatively low efficiency and did not meet hygienic requirements. Wet separators reached acceptable levels of separation, but their tendency to become clogged with sediment limited their usefulness. A new aerosmechanical separator processes dust in agglomerations at an efficiency level of 95%; the diameter of this apparatus is 630 mm. A new venturi-type separator of rectangular cross sections separates micron and submicron particles from the brown smoke produced in metallurgical processes. Extremely good results were obtained when this scrubber was used to treat combustion products from open and double hearth furnaces in pilot plant operations.

5289

APTIC NUMBER 15319

Storp, Klaus
CLEAN AIR MAINTENANCE THROUGH ADSORPTION, ABSORPTION, AND CONDENSATION PROCESSES. (Luftreinhaltung durch Adsorptions-, Absorptions- und Kondensations-Verfahren). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(10):295-300, 1969.

During condensation, vapors are cooled to below the dew point by heat exchange with the ambient medium and converted into liquids. This change causes a large decrease in volume, which varies directly with temperature and indirectly with total pressure of the vapor-air mixture. The condensation method is relatively low in cost. After a review of the principle of absorption, various absorbents are discussed. In thin layer absorption, the absorbent flows along the tube walls as a thin film. In packed absorption columns, the absorbent flows in a direction opposite to the gas. There is another method where the absorbent is sprayed into the gas flow. The principles and methods of adsorption are discussed. Rate of adsorption increases with increasing concentration of the adsorbate. The grain size of the adsorbent becomes of importance at a bulk height of 1 to 2 m. In practice, grains between 2 to 4 mm in diameter have proved suitable. Activated charcoal can be used for adsorption of gaseous pollutants, as well as for mists and aerosols. Activated charcoal impregnated with salts can be used for adsorption of H2S, HCN, and mercury vapors. At very high pollutant concentrations, the catalyst must be regenerated.

5290

APTIC NUMBER 15311

Strader, Don S.
EXHAUST GAS CONDITIONER. (Envirotech Corp., Salt Lake City, Utah) U. S. Pat. 3,466,868. 4p., Sept. 16, 1969. 5 refs. (Appl. Feb. 23, 1968, 3 claims).

This invention relates generally to apparatus for conditioning the exhaust gases from internal combustion engines to cleanse, dilute, and cool them before final discharge. The invention is particularly suited to closely confined operations such as underground mining. The gas conditioning apparatus continuously treats the flowing stream to effect scrubbing in a fluid spray followed by dilution with concomitant cooling. The conditioner includes a contact chamber for receiving the engine exhaust gases, a device for injecting a fluid spray into the gases in the chamber, an elongated open-end dilution chamber, and a gas discharge nozzle inside the dilution chamber directed axially toward the outlet. The nozzle is placed away from the chamber sidewall to enable gas flow through the chamber. A conduit is provided for directing the gas from the contact chamber to the nozzle for axial injection of the dilution chamber to induce the flow of fresh air into and through the chamber to act as a diluent for the exhaust gases. The air flow may be augmented by flaring the dilution chamber inlet and/or by forcing air into the dilution chamber. The rate of supply of the scrubbing liquid and the diluent air may be varied in direct proportion to the engine speed to accommodate variations in the gas flow rate and temperature.

5291

APTIC NUMBER 14358

Strauss, W.
DIRTY AIR CAN CAUSE PLANT SHUTDOWNS. Factory and Plant, p. 18-23, Sept. 1968. 2 refs. (Also: Chem. Process. (Chicago)).

Removal of particulates from the environmental air of industrial sites by fiber filtration is described. In such processes, particles of the same or larger dimensions as the diameter of the fibers in the collecting medium are generally captured by inertial impaction and interception, while smaller particles are captured by their diffusion to the fiber surface. It is considered good practice when collecting fine particles to have a relatively deep bed, with fibers as fine as is feasible for a stable bed structure. The velocity through the bed must be based on an economic balance, with smaller bed sizes, higher pressure losses, and lower efficiency being offset against greater costs and other process considerations. Air conditioning systems can be modified for the collection of fine particles by the use of pleated filter media or the two-stage positive corona electrostatic precipitator, which produces almost none of the nitrogen oxides and ozone caused by the usual industrial negative corona precipitator. Various types of filters are reviewed, including fibrous and viscous filters. The deep-bed filter, consisting of a 2-in. bed of glass fibers and fire-resistant felt filters, is considered relatively effective. Very high efficiencies in collecting very fine dusts, such as methylene blue, are obtained with the 'Absolute' filter, which also has the advantage of eliminating the bulk usually associated with high-efficiency filters; its cost, however, remains high. Apart from the primary function of air filters in preventing contamination and subsequent deleterious effects on equipment, an important secondary consideration is their role in industrial safety to remove the fine airborne dust, particularly of metal origin, which represents a fairly serious health hazard to workers. Removal of odors and organic vapors from air streams by adsorption of the vapors on the micropores of a solid, most commonly activated carbon, is also described.

5292 APTIC NUMBER 13623

STUDIES AND RESEARCH ON THE DESULFURIZATION OF FUMES AND OF MOTOR-FUELS IN ITALY. Translated from French. (Source unknown), (3)p., Jan. 1969.

Research on the desulfurization of fumes and of motor-fuels in Italy are the objects of concern in Italy on the part of producers of sulfuric acid, large producers of thermal energy, especially the National Union of Hydrocarbons - L'ENEL, and research centers such as the Experimental Station for Combustibles. In the first category, a method has been developed and tested in an Italian chemical plant for the elimination of traces of SO2 present in the gas discharged from production units of sulfuric acid and other chemical factories. In the second category, the activities of the ENEL, which are rather intense and extensive, are limited to the following fields: a) calculation, evaluation, control of high stacks for the efficient dispersion of pollutants into the atmosphere, and b) comparative study of the various proposed procedures, studied or tested for the desulfurization of fumes, with or without recovery of sulfur. In the third category, studies are in progress near the S.S.O. with reference, until now, to the hydrodesulfurization of distillates and crude petroleum. Preliminary studies will be started on the dry desulfurization of alumina of different composition and structure. Studies have been made and are still in progress in reference to the catalytic purification of discharge gases. These studies, however, aim essentially at the reduction of the hydrocarbon and carbon dioxide content, the content in sulfur dioxides originating from gasoline engines being altogether negligible.

5293 APTIC NUMBER 15640

Sullivan, Billie P.
SMOG REDUCING CARBURETOR. (Automotive Development Corp., Calif.) U. S. Pat. 3,471,132. 6p., Oct. 7, 1969. 11 refs. (Appl. Dec. 18, 1967, 9 claims).

A venturi-less carburetor is described in which the movement of the throttle valve controls the rate of fuel discharge and in which fuel is discharged into the engine induction system through the throttle valve shaft. The carburetor embodies several features for improving combustion in internal combustion engines and for reducing the emission of smog-producing constituents from the induction system. The smog-reducing features include an accelerating pump with a discharge circuit responsive to an induction system vacuum for bleeding fuel into the carburetor during severe decelerations, an improved fuel discharge nozzle bar, and a system for retarding the spark advance on such decelerations. (Author abstract modified)

5294 APTIC NUMBER 18818

Swift, Peter
DUST CONTROL IN INDUSTRY - 2. Steam Heating Eng. (London), 38(453):10-16, 85, Aug. 1969.

The design and application of cyclones in the practice of dust control are discussed. Cyclones were developed almost completely by experiment and it would be difficult to prove mathematically which cyclones are of the best design. A cyclone has to operate with spinning speeds of 50-150 ft/sec and be sufficiently long to give an inward drift velocity of 1-8 ft/sec. With these two guiding rules, the main proportions of a cyclone are derived. In deciding upon the use of a cyclone design for a particular duty, capital costs, operating costs, and collection efficiency must be considered. Practice has shown that no single design is suitable for all applications; thus, three types have emerged: high efficiency, general purpose, and high throughput. A cyclone cannot be 100% efficient. The practice of using single cyclones as the main and only dust collector is being abandoned, but a cyclone preceding a fabric filter makes an excellent pre-separator. Use of single cyclones occurs when the dust to be collected is in the form of chips or very large particles. Cyclone plants handling dusts are usually more complex and are fitted with some form of secondary filtration. To rectify the low collection efficiency, baffles, multicyclones and water are being used, but they are still sensitive to changes in working conditions. Poor distribution of dust-loading, enhanced abrasion or power requirements, and increased maintenance through partial

water supply failure are all factors which may have to be considered if the improvement in basic performance is to be obtained.

5295 APTIC NUMBER 15177

Swift, Peter
DUST CONTROL IN INDUSTRY. 4. Steam Heating Eng. (London), 39(855):82-84, 11, Oct. 1969.

Attention is focused on the dust cake that forms on the upstream side of fabric filters. Permeable to air flow but restrictive to dust particles, the cake is helpful to filtration. It enhances collection efficiency by limiting filter resistance to air flow and minimizing variations in air flow velocity. Unacceptable levels of resistance can be determined by following the cake's rate of growth and strength of adhesion. The size distribution of dust has a direct bearing on the filtration velocity that can be applied. Filtering at velocities greater than those indicated by size distribution leads to unacceptable levels of resistance. Shape factors affect the degree of resistance exercised by the dust cake for any given cake thickness, dusts with a high length/breadth ratio being less resistant to air flow than their more spherical counterparts. The free-flow ability of dust is a clue to its adhesive tenacity and to the duration of the required cleaning cycle. If air flow is continued during the cleaning period, the resulting pressure drop can lock the dust cake to the fabric. Consequently, effective cleaning is achieved during periods of new air flow. Improved methods of air cleaning are represented by reverse air procedures which in some cases shorten the cleaning period to 0.2 sec. High-pressure reverse air filters can be cleaned frequently to reduce dust cake accumulations.

5296 APTIC NUMBER 15100

Szepesy, Laszlo and Allesandro P. Giona
REMOVAL OF TRACE AMOUNTS OF NITRIC OXIDE BY ADSORPTION. (Kis mennyisegu nitrogen-monoxid eltavolitasa adszorpcioval). Text in Hungarian. Magy. Kem. Folyoirat, 71(9):399-403, Sept. 1965. 6 refs.

The presence of 0.1-0.8 ppm nitric oxide during the nitrogen washing of synthesized ammonia might result in an unexpected and powerful explosion. This study investigated the feasibility of NO removal by adsorption and selection of the most suitable adsorbent. For the test work, NO was produced by Emich's method, and NO analysis was performed by the Saltzman method using a Lange Colorimeter. Three kinds of ion-exchange material (type 200, Imac A 17, and Imac C 12), two kinds of molecular sieves (5A and 13X), silica gel, and activated carbon were used as adsorbent materials; all materials were in the form of 40-60 mesh sieve fraction. Only the 5A molecular sieve and the activated carbon (Carlo Erba, Norit) gave appreciable breakthrough times. Test results of dynamic adsorption measurements are presented for the two chosen materials, giving the velocity of progression of the adsorption zone as a function of NO concentration and linear gas velocity, and the adsorption isothermal lines in the investigated concentration regime (0-13 and 20 ppm) for activated carbon.

5297 APTIC NUMBER 14980

Tada, Mitsuru
INDUSTRIAL WASTE INCINERATION BY FLUIDIZING SYSTEM. (Sangyo haikibutsu no ryudoshokyakuho). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(7):529-533, July 1969.

Fluidizing systems, which are widely applied to petroleum and mineral combustion, are highly efficient. The outstanding merits of this system are a capacity of 500 kg/cu m-hr incineration; the ability to incinerate low-calorie wastes (1000/kcal/kg, water 70%) without catalysts; perfect combustion with kiln heat around 750 C; no stack smoke or odor problems; simplicity of structure, with no vibrations inside the kiln and constant and stable internal heat; availability of electric power, produced though the process in large-scale (400 t/day) kilns of this system; convenient operation requiring no heavy or intensive labor; and economical maintenance. The system has a wide range of applications, including waste incineration in the chemical, food processing, and petroleum industries, and excrement and sludge treatment. For example, the liquid wastes from paper manufacturing plants that used to be discharged into rivers, bays, or seas and caused problems for agriculture, fishing, and shipping may now be incinerated, removing all the organic matter contained in pulp wastes, and chemical compounds such as Na2SO4 or Na2CO3 may be recovered and reused in kraft pulp production. Adaptation of this system to watery wastes in the food and chemical industries has the advantages of deodorizing wastes and recovering ash for use as fertilizer. The system can be adapted to petroleum and petrochemical wastes and to high-temperature wastes.

5298 APTIC NUMBER 14988

Tamura, Tensuke, Yukio Nishimura, and Teruo Misamura
DESULPHURIZATION PROCESS OF FLUE GAS BY ACTIVE CARBONS. Hitachi Rev. (English translation from Japanese of: Hitachi Hyoron), 17(9):383-389, 1968. 3 refs. (Also: Karyoku Hatsuden (Thermal Power Generation), 18(4):361-365, 1967.)

The active carbon adsorption process for desulfurization of boiler flue gas and test results were described for the 6000 N cu m/hr experimental plant built as a first stage of large-scale research and development projects. The flue gas from the air heater of the boiler is stripped of soot and dust, then blown into a tower packed with active carbon. The purified gas is discharged through the chimney. The bypass flue duct is used when the boiler is being started or stopped, when operation of the desulfurization unit is suspended, or during emergency shutdown. Active carbon is contained in a number of towers which are classified by function. In the drying tower section, wet active carbon from the washing and desorption section is dried with the heat of the boiler flue gas, while adsorption of SO2 is achieved. In the adsorption section, SO2 in the flue gas is completely removed. At the same time, water

particles and mist contained in the gas from the drying section are removed. The washing and desorption section is designed to wash the active carbon that has adsorbed SO2, extract sulfuric acid and regenerate the carbon for further use. Advantages of the process include a high desulfurization rate, easy desorption and regeneration, flue gas temperature over 100 C, carbon sufficiently dried by the boiler flue gas, a process not affected by geographical or natural conditions, safe operation, and no need to change boiler structure. Operational results from the test plant were given. They showed that the plant was operated smoothly and the practical value and effectiveness of the process were confirmed by various tests. However, in order to industrialize the process, plant size should be expanded. By doing so, structural problems that may arise from the operation of a larger plant, as well as operation in combination with a boiler, should be studied.

5298 APTIC NUMBER 15170

Tanaka, Isamu
A PRACTICAL EXAMPLE OF OILY WASTE INCINERATION. (Yusei sangyohaikibutsu no nenshoshori no jitsurei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):711-714, Sept. 1969.

The operation and efficiency of the Katayori oily waste incineration system which is in use at a chemical plant is reported. Incineration of urethane, rubber, vinyl chloride, waste solvents, rubber paste, and the like produces stack odors and toxic gas. The SP-type incinerator was designed to burn all the waste solvents such as toluol, thinners, xylol, rubber solvents, and gelled rubber refuse. The SP-type plant consists of an oily waste incineration kiln (2.5 t-3.0 t/8 hrs), annexed installations consisting of five oily waste tanks, two gearpumps, two blowers, and a conveyor. In case of liquid waste, the waste is first pressurized by a gearpump, checked by inflow control valve, and then brought into the incinerator at a fixed quantity and interval. Gelled waste is canned and put into the incinerator in batches. In this type of incinerator, the smoke and gas from the first combustion are conducted to a second incinerator and heated to 800-900 C; in a third incinerator the gas is heated to 1100-1600 C, and in a fourth incinerator it is discharged at 800-850 C as dustless, non-toxic gas. An additional merit of the SP-type incinerator lies in utilization of surplus heat from waste gas combustion; the heat is recycled for the incineration energy source, facilitating perfect and economical combustion. The SP-type incinerator, therefore, is designed to be durable at high temperature, and all the inside fittings are fireproof.

5299 APTIC NUMBER 18956

Tanaka, Isamu
AN EXAMPLE OF INDUSTRIAL WASTE TREATMENT. BRIDGSTONE TIRE INDUSTRY, YOKOHAMA PLANT. (Kagakusangyo haikibutsu no shori jitsurei. Brigiston taiya (kabu) Yokohama kojo niokeru ichirei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(7): 535-540, July 1969.

A newly-designed kiln (SP type) for industrial rubber and urethane waste treatment is described. The SP type-kiln was first examined with respect to stack smoke and toxic gas, and treatment cost reduction. Perfect incineration of synthetic rubber and foaming urethane is characteristic of this kiln. The main feature of the kiln is that the waste and organic gas produced during combustion in the incinerator is directed to a second incinerator, heated up to 1000-1600 C, and finally discharged in dustless and odorless form. The SP type-kiln is fireproof and is designed to keep the kiln heat constant. Kiln no. 1 was designed to treat synthetic solid wastes and rubber-urethane wastes with a capacity of 1 t/7 hrs, and kiln no. 2 for metallic materials of rejected rubber articles at low temperatures with a 1 t/7 hrs capacity. Operating efficiency of kiln no. 1 is reported as highly reliable and effective. Combustion rate was constantly 115-125 kg/sq m-hr and 977,500-1,062,500 kcal/sq m-hr in the case of synthetic rubber. After perfect combustion, the standard smoke volume was 0-0.1 g/N cu m, and Ringelmann density was 0-0.1 degree. These figures are far below the standard stipulated in the Air Pollution Control Law. Odors were removed by 700-800 C heat in the kiln.

5301 APTIC NUMBER 18225

Tanaka, Kusuyata, Osamu Sakabe, Misao Kawai, Sinzo Hirasawa, Kunio Miyajima and Masaaki Oya
DESULFURIZATION OF COMBUSTION EXHAUST GAS BY LIME INJECTION (I). Translated from Japanese. Natural Resources Research Laboratory (Japan), n. 656, (1968).

An experiment is described wherein combustion exhaust gas is desulfurized by lime injection. The test furnace consisted of a combustion room, a cooler to adjust the gas temperature, and a reaction tower 9 m in height and 0.4 m in diameter. All relevant parameters are described. Desulfurization rates of the lime and precipitated calcium carbonate were measured in 0.2% percent and 0.3 percent SO2 at 1100 degrees C. The relationship of the amount of lime added to the desulfurization rate cannot be determined precisely because only two different quantities were added. Two temperatures (1100 degrees C and 1050 degrees C) were studied on the lime with a grain mesh of 200 under the precipitated calcium carbonate. As a result, 5-10 percent higher desulfurization occured at 1050 degrees C.

5302 APTIC NUMBER 13721

Tanaka, Kusuyata and Misao Hattori
DESULPHURIZATION AND ATMOSPHERIC DIFFUSION OF FLUE GAS. Proc., World Power Conf., Tokyo, Oct., 1966, p. 1403-1413. (Presented at the Tokyo Sectional Meeting, Oct. 16-20, 1966, Paper 145.).

Japan imports 85% of its coal from the West East, and since the mean sulfur content of this coal is 2.28%, air pollution is a pressing problem. Wet methods of desulfurization are not practical because the required cooling of waste gases decreases the diffusion of contaminated air in the vicinity of power plants. Dry methods, including adsorption, absorption, and catalytic processes, have been studied for 10 years, but none has yet been

put to practical use by power stations. Gas conveying absorption appears to involve the fewest chemical engineering problems, and pilot plants are currently experimenting with activated manganese and lime blow-in methods. In the former method, powdered MnO2 absorbs SO2 and SO3 at 100-150 C. The absorbent is separated from the gas by electric collectors after which part of it is returned to the gas stream for recycling, and part is regenerated as MnO2. The lime process does not require regeneration. The construction of tall chimneys for the diffusion of stack gases is reported. For prediction of diffusion from chimneys, theoretical investigations by diffusion equations, field investigations, and wind tunnel experiments are employed.

5303 APTIC NUMBER 14395

Tanaka, Shichinosuke, Takanao Niwa, Haruni Mirai, Tadami Iwatake, Yoshio Harada, and Yoshiro Sakamoto
OPERATING EXPERIENCE AND CORROSION PREVENTIVE MEASURE OF RESIDUAL FUEL FIRING GAS TURBINE. (Mitsubishi Heavy Industries, Ltd., Tech. Rev., 5(3):196-207, Sept. 1968. 10 refs.

A 15 MW gas turbine is one of the few commercial gas turbines for base load power plants using grade C heavy oil and operating at an inlet temperature of 732 C. The risk of corrosion of turbine blades exists due to the corrosive nature of the fuel and the increase of radiant heat, resulting from the combustion of the oil, which causes a rise in the surface temperature of the blades. To prevent blade corrosion and to minimize the corrosive ash contained in the fuel, the fuel is washed with water and its water-soluble contents are removed with an emulsion breaker. Sodium in the fuel is reduced below 5 ppm and the ash quantity is halved by this treatment. A magnesium hydroxide inhibitor added to the fuel prevents corrosion by vanadium compounds. Turbine blades are further protected against corrosion by coating with Inconel 700 and Inconel X alloys. After 16,000 hrs of continuous operation, the average corrosion per blade is only 2.9 g. Deposits on the blade consist primarily of magnesium and vanadium, whose ratio varies according to the position of the blade. Deposits on the combustion basket, which could lead to its deformation, are composed of magnesium. Use of the magnesium hydroxide inhibitor is considered indispensible, but measures to achieve a more uniform distribution of magnesium are being studied.

5304 APTIC NUMBER 15372

MAINTENANCE OF AIR PURITY AND DETERMINATIONS OF IMMISSION BY THE ALUMINUM INDUSTRY: FLUORINE POLLUTION, ESPECIALLY HYDROGEN FLUORIDE GAS, IN WASTE GASES CAUSES DAMAGE TO VEGETATION. (Luftvard och immissionskontroll i aluminiumindustrin: fluorforeningarna, sarskilt det gasformiga fluorvatet, i avgaserna). Text in Swedish. Tek. Tidskr., 99(12):251-253, May 27, 1969.

The Sundsvall aluminum plant, the only alumina-electrolysis plant in Sweden, operates 300 cells currently producing 65,000 tons of Al per year, representing a fivefold increase of production since 1962. To date the company has spent 20 million kronor (about $4,000,000 in 1969) on air pollution control equipment, but there is still some damage to vegetation from hydrogen fluoride gas. Comfort of workers requires 20 to 30 changes of air per hour (12 million cu m/hr) in pot-line area, which complicates air pollution control. Most recent of several air-washing devices used in a 'spin bath' in which plastic balls are sprayed with water from jets. Exhaust gases escape through four 70-m concrete chimneys, 10-11 m in diameter and lined internally with plastic. The equipment removes 90% of water-soluble fluorides from exhaust. The company also maintains 160 inspection stations in the area, which by means of pollutant-sensitive plants record the immission of toxic material, which is the basis of a map of Sundsvall region with 'isofluoride' lines to indicate pollution zones.

5305 APTIC NUMBER 15836

Teller, Aaron J.
RECOVERY OF SULFUR OXIDES FROM STACK GASES. Preprint, Metropolitan Engineers Council on Air Resources, New York, N. Y., 11p., 1967. (Presented at the Symposium of the Metropolitan Engineers Council on Air Resources, New York City, Oct. 1967.)

The following problems are associated with sulfur oxides recovery: effect and handling of particulates generally in the micron-submicron range following a precipitator or existing in oil-burning effluents; contaminating effects of sulfur trioxide particulates; wide variation in gas loading with as much as 6:1 turndown; and restricted availability of land in proximity to power plants. The following criteria should be used for the selection of a recovery process: stability of the chemical or physical recovery system to the submicron particulates and sulfur trioxide; stability of the adsorption or catalytic material; turndown capability of the system; and land area required by the recovery system. Effective recovery of sulfur dioxide in a non-regenerative form can be achieved with lime scrubbing; however, lime feed must be approximately 125% of stoichiometric amount in order to achieve 98% recovery, creating a solids disposal problem. Another non-regenerative process consists of a dry reaction of sulfur dioxide, oxygen, and lime at temperatures in the 1500 to 2000 F range, with an expected 25% recovery; the restrictive factor is the contact time. Regenerative processes offer the greatest potential for economic recovery and a preservation of the natural resource of sulfur and are classified as follows: alkalized alumina adsorption; direct catalytic conversion to sulfuric acid; char adsorption; absorption accompanied by chemical reaction; and reversible chromatographic separation.

5306 APTIC NUMBER 15886

Tenney, Mark W. and T. Gerald Cole
THE USE OF FLY ASH IN CONDITIONING BIOLOGICAL SLUDGES FOR VACUUM FILTRATION. Water Pollution Control Fed. J., 40(8) part 2: R281-R302. Aug. 1968. 30 refs.

The use of fly ash as a sludge conditioner will enhance dewatering of both activated and digested sludges. The implementation of

this type of conditioning would eliminate any costs for conditioner chemicals; the only cost would be that for transporting the fly ash to the wastewater treatment plant. The most desirable fly ash is one with a high carbon content and a particle size in the range of 10 to 30 microns. Its addition to biological sludge facilitates the ease with which the sludge can be dewatered, leaving a residual filter cake of low moisture content, and contributing to the potential fuel value of the cake. The requisite fly ash concentration is influenced by very few physical, chemical, or biological properties. Comparison of experimental data on activated sludge dewatering indicates that for a fly ash dosage of 50 g/l, dewatering is nearly optimum, percent moisture content of the filter cake is almost reduced to its asymptotic value, cake heat is highest, and complete phosphate removal has occurred. Investigations are being conducted on the application of fly ash in the area of reuse of wastewater. It is also thought that it may have a potential use in improving the water quality of small eutrophic lakes.

5307 APTIC NUMBER 13756

Teplitskii, M. G., Y. Z. Gordon, G. A. Aleinikov, N. Al. Kudryavaya, and A. N. Pyatigorskii
DUST REMOVAL FOR A TWIN-PATH STEELMELTING FURNACE. Steel (USSR) (English transl.), no. 8:709-713, Aug. 1968.

Working conditions in a gas cleaning plant comprising a wet scrubber, an electrostatic filter, and a suction fan were examined and their influence on the efficiency of the dust removal was investigated. The dust formed and carried out of the twin bed furnace was assumed to be less than that from other steel melting units using oxygen lancing, because of good separation of the dust and the relatively small volumes of gases formed in the working space of the furnace. The scrubber was designed to ensure (1) cooling of flue gases to 200 C, and (2) at the same time, an increase in their moisture content. The electrostatic filter installed beyond the scrubber is the experimental PGDS-50-3 model. Its electrodes are in the form of plates with S-shaped elements, a design suitable for the removal of fine particles with a high specific electrical resistance. The experimental filter also incorporates improved means of gas distribution and improved mechanisms for shaking the electrodes. Furnace trials show that the volume of flue gases reaching the gas cleaning plant exceeds design values; as a result, gas cleaning units are overloaded. The higher velocity of the gases increases the carryout of moist particles from the scrubber, and this leads to the formation of deposits in the gas duct in front of the electrostatic filter. Resistance to flow through the gas cleaning line is increased. To meet health regulations, it will be necessary to replace the scrubber and the ducts leading to it, and to install a second electrostatic PGDS filter parallel with the existing one.

5308 APTIC NUMBER 12795

Tepper, Frederick, John S. Greer, William J. Cooper, Elliott Goldberg, Faustino G. Prado, and Don Lee Stockton
INORGANIC LIQUIDS FOR REMOVING SO2 FROM FLUE GASES, PHASE I (INTERIM REPORT). MSA Research Corp., Evans City, Pa. and Singmaster and Breyer, New York, 181 p., April 9, 1969. 560 refs.

A literature survey was performed to determine the applicability of inorganic liquids to the development of new processes for removing SO2 at flue gas temperatures high enough to prevent excessive cooling of the stack gas. Phase and solubility data were studied to find liquids that would be suitable for use in the preferred temperature regime of 200-600 F. The survey included analysis of low melting metal alloys and molten salts as solvents for inorganic compounds that would react with SO2. Thermo dynamic data were gathered so that promising SO2-reactants could be identified. Lead, tin and other white metal oxides appear to react with SO2 at about 400 F. Thermal, chemical and electrochemical regeneration routes would be effective if the absorption products were sulfites. The white metal sulfates are only thermally regenerable at higher temperatures. Selected experiments were performed to furnish information on which absorption reactions would 'go'. These experiments included tests on solubility, compatibility of fluids with simulated flue gas and bubbler absorption tests. Candidate schemes were chosen for engineering and economic evaluation. The liquid metal scheme involves absorption of SO2 by lead-tin eutectic at about 400 F. A second process involves SO2 absorption by limestone dissolved in molten nitrate at about 250 F. In a third system, magnesium sulfate removes SOX by complex formation and is regenerated by steam stripping. Preliminary economic evaluation was made on the basis of an 800-megawatt plant operating at a plant factor of 91.2 percent. Net annual operating costs appear favorable for several of the candidate processes. Recommendations are made for further study of these candidate systems and for investigation of other schemes based on inorganic liquids.

5309 APTIC NUMBER 15322

Teske, Wolfgang
AIR POLLUTION CONTROL IN THE CHEMICAL INDUSTRY. (Luftreinhaltung in der chemischen Industrie). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(10):289-298, 1969. 11 refs.

Emissions developing from chemical production processes can be reduced either by modification of the process itself or by cleaning the stack gas. As an example of the first approach, the so-called double contact process is described. Sulfur dioxide from pyrite roasting is converted by catalytic oxidation with atmospheric oxygen to SO3. By addition of water, the latter is converted into sulfuric acid. The reaction is not complete; in the first stage of the process, 90% of the SO2 is converted to SO3, which is removed from the reaction gas mixture by absorption. The remaining 10% SO2 is converted to SO3 in the second stage. The residual SO2 concentration in the cleaned gas lies between 0.5 and 0.7 g/std cu m. The emission of NO and NO2 can be reduced by the use of higher pressures either during combustion or prior to absorption. The dust emissions from acetylene production can be reduced through the construction of a completely closed furnace from which no waste gas can escape without having first been cleaned. For cleaning of waste gases, there are several wet and dry methods. Hydrogen sulfide and carbon disulfide from the manufacture of synthetics are removed from the waste gas by adsorption on two layers of

activated charcoal. Silicon tetrafluoride and hydrogen fluoride can be removed by venturi scrubbers, by Doyle scrubbers, where the gas is accelerated in an annular nozzle so that it hits the scrubbing liquid at high speed, by cyclone scrubbers, or by spray chambers.

5310 APTIC NUMBER 18605

Theodore, Louis
DESIGN OF A CENTRIFUGAL SEPARATOR USING MODELLING AND SIMULATION TECHNIQUES. American Institute of Chemical Engineers, New York, N. Y., American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., American Society of Civil Engineers, New York, American Society of Heating, Refrigerating and Air Conditioning Engineers, New York, American Society of Mechanical Engineers, New York, and American Society for Testing and Materials, Philadelphia, Pa., Proc. MACA Symp., Design and Operation for Air Pollution Control, New York, N. Y., 1968, p. 91-105.

A mathematical model was developed for describing the flow pattern of a particle in a centrifugal separator. It assumes that the aerosol entering the separator consists of a gas and either atomized liquid or solid particles, that the velocity factor of the particle is a function of its radial position, that separation occurs when the particle reaches the outer wall of the separator, and that the thermal, sonic, and electrostatic forces are negligible. Forces exerted on the particle are centrifugal, drag, and resultant. The model can be used to evaluate the effects of new and/or different separator geometries, other aerosol properties, different particle-sized and particle-distribution aerosols, and varying operating conditions. This can be accomplished with only slight calculational modifications. The equations developed are solved by programmed instruction for a digital computer. The model provides an effective tool for simulating air pollution control equipment.

5311 APTIC NUMBER 18598

Theodore, F. W.
LOW SULFUR BOILER FUEL USING THE CONSOL CO2 ACCEPTOR PROCESS: A FEASIBILITY STUDY. Consolidation Coal Co., Library, Pa., Research Div., Contract 14-01-0001-415, Rept. 2, 78p., Nov. 1967. 17 refs.
CFSTI: PB 176910

The use of dolomite (Consol CO2 Acceptor Process) may be applied to the production of low-sulfur char and gas in two ways: (1) as a sulfur acceptor in the simple devolatilization-desulfurization of coal, or (2) as both a source of heat and as a sulfur acceptor in a combined desulfurization-partial gasification plant. In each case, either high-BTU pipeline gas (Option A) or high-purity hydrogen (Option B) can be produced. In Option B, hydrogen purification is based on cryogenic separation, which results in the production of a high-value fuel gas as a third product. This can be added to the boiler char to lower the sulfur level in the total boiler fuel; as an alternative, it can be used as clean reformer fuel in the context of a large coal desulfurization plant. Feasibility studies of the four applications indicate that (2), Option B is the most economically attractive process. It produces a low-sulfur boiler fuel at no increase in boiler fuel cost and two by-products: marketable quantities of elemental sulfur and low-cost, 95% pure hydrogen. Credit for hydrogen should more than cover total operating costs. If all fuel gas and char are burned together and credited at 18.5¢/MM BTU (1967 figures), the resulting cost of hydrogen is 20-25¢/MCF. The economics of this operation are particularly attractive if the process is considered as part of an integrated coal-to-gasoline/gas complex which can utilize the low-cost hydrogen. This process would not require the lengthy power plant shutdowns that are necessary for the installation of stack gas cleaning equipment.

5312 APTIC NUMBER 18802

Thornton, James P. and Morgan C. Sze
STACK GAS CLEANING PROCESS. (The Lummus Co., Inc., New York) U. S. Pat. 3,456,622. 8p., July 22, 1969. 4 refs. (Appl. July 24, 1967, 11 claims).

The object of the invention process is to provide an effective means for removing undesirable matter, especially sulfur compounds and fly ash, from a plant off-gas. Another object is to provide cooling for the plant coolant. These objects are accomplished when the flue gas, containing sulfur dioxide, is scrubbed by direct contact with water, preferably containing $CaCO_3$, in an intermediate portion of a combined cooling tower-stack. At the same time, coolant water at an elevated temperature is withdrawn from the plant and cooled by direct contact with unsaturated atmospheric air in a lower portion of the combined cooling tower-stack to effect cooling by evaporation. The air, now saturated with water vapor, is combined with the scrubbed off-gas in the stack. The sulfur dioxide is absorbed by the water and the diluted off-gas is released to the atmosphere. This gas-cleaning process may be effectively incorporated into existing equipment. (Author abstract modified)

5313 APTIC NUMBER 15284

Titov, N. G. and I. A. Borozdina
ON THE RELEASE OF SULFUR OXIDES INTO THE AIR DURING COMBUSTION OF SOLID FUELS. (K voprosu o vydelenii v vozdukh sernistykh gazov pri szhiganii tverdykh topliv). Text in Russian. Khim. Tverd. Topl., no. 5:100-107, 1968. 8 refs.

Study of the combustion of sulfur-containing coals from various sources has revealed the need for taking into account the composition and properties of the organic and mineral portions of the fuel. It was found that with fuels containing calcium and magnesium humates, the initial combustion stage is accompanied by decomposition of the humates with the appearance of calcium and magnesium oxides which readily combine with sulfur oxides formed during the burn-out of pyrite and organic sulfur compounds, to yield non-volatile sulfates. Naturally-

occurring calcium and magnesium present in the coal in the form of gypsum, calcite, ferrocalcite, dolomite, etc., are not available for such reaction, since formation of their oxides takes place at too-high temperatures. One means of combating pollution by sulfurous products of combustion might be joint combustion with appropriate quantities of lowland fuels and earthy lignite which usually contain significant quantities of calcium and magnesium humates.

5314 APTIC NUMBER 15300

Toos, Istvanne
NEUTRALIZATION OF HYDROGEN SULFIDE RELEASED FROM OIL REFINERY PROCESSES. (Asvanyolajiparban keletkezo kenhidrogengaz semlegesitese). Text in Hungarian. Munkavedelem, 14(4-6):1-8, 1968. 18 refs.

According to Hungarian industrial health standards, the maximum permissible hydrogen sulfide concentration in workshops is 10 mg/cu m. Catalytic reforming and fuel oil desulfurization processes in the Petrochemical Works of Komarom produced (after ethanolamine extraction) a flow of 220-650 kg/hr; 98% of the gas was pure H2S, and only 2% was H2O or light hydrocarbons. To remove H2S, economic studies suggested the use of absorption methods giving Na2S as the end product. The process first involves obtaining 72% concentrated NaOH-H2O solution from a 45% starting solution in a vacuum still, at 80-90 C. Then the gas mixture containing H2S will be reacted with the NaOH solution; the Na2S crystals produced are distilled in one or two steps depending on their water content. The remaining gas is transferred from the reactor vessel to cadmium acetate washers where the unreacted H2S is absorbed. The NaOH concentration will control the reagent content of the developing Na2S; the NaOH concentration may be controlled by temperature and pressure regulation. No further cleaning of the Na2S is necessary.

5315 APTIC NUMBER 14850

Trayser, D. A., P. A. Creswick, J. A. Gieseke, H. P. Hazard, A. P. Weller, and D. W. Locklin
A STUDY OF THE INFLUENCE OF FUEL ATOMIZATION, VAPORIZATION, AND MIXING PROCESSES ON POLLUTANT EMISSIONS FROM MOTOR-VEHICLE POWERPLANTS. Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract CPA 22-69-9, Phase Rept., 145p., April 30, 1969. 120 refs.

A study of automotive engine induction systems was conducted. The objective of this non-experimental program was to explore incentives and approaches for reducing exhaust emissions by extending the lean-mixture operating limit through improved induction-system performance. The study was divided into four major subtasks: development of mathematical descriptions of induction-system phenomena; evaluation of methods for measuring mixture characteristics; conception of approaches to the definition and measurement of mixture quality; and evaluation of alternative atomization methods. The results of this study indicated that extension of the present limits, made possible by improved air-fuel distribution, can lead to modest but worthwhile reductions in emissions of both unburned hydrocarbons and carbon monoxide and to substantial reductions in the emission of nitrogen oxides. Minimizing or eliminating the liquid-fuel film on the intake manifold walls was concluded to be the most promising approach to achieving improved distribution. The liquid film can be reduced by employing atomizing devices that will produce droplet sizes approaching 10 to 20 microns under all operating conditions, by designing the induction system for minimum impaction of fuel droplets, and by heating the manifold walls to vaporize the fuel that is avoidably impacted. Recommendations included an experimental program comprising the design, fabrication, and evaluation of an induction system with a carburetor employing an alternative, improved atomization device and a low-impaction intake manifold.

5316 APTIC NUMBER 13718

Trofimov, A. T.
REMOVAL OF NITROGEN OXIDES FROM COKE OVEN GAS. (Ochistka koksovogo gaza ot okislov azota). Text in Russian. Koks i Khim., no. 2:42-43, 1966.

An arrangement for removal of nitrogen oxides from coke gases, installed at the Yasinovskiy Coal-Tar Chemical Plant, is described. It converts NO to NO2 (in 110-120 sec at 70-80 C and 15-16 bar), which in turn reacts with olefins to form a resin which, after cooling to 30-40 C, is washed in a scrubber filled with residue from 50 x 50 mm Raschig rings. The installation was designed for operating with a 0.8% oxygen content in the coke gas, but 0.6-0.5% oxygen is found sufficient, precluding the need for introducing air. Operational reduction of nitrogen oxides is from 12-18 to 2-3 cc/cu m. This arrangement was installed at a cost of 234,000 rubles.

5317 APTIC NUMBER 18888

Tsujimura, Shigeo, Akira Takahashi, and Ginji Fujisawa
CONSTRUCTION OF DIFFERENTIAL PRESSURE GAGE FOR FLUORINE AND ITS APPLICATION TO AUTOMATIC DISPOSAL OF FLUORINE. J. Nucl. Sci. Tech., 5(1):30-36. Jan. 1968. 9 refs.

A differential pressure gage for fluorine, consisting of two metal bellows connected end to end was constructed. This device can be applied in measurement of pressure drop across fluid bed reactors, pack bed reactors, filters, orifices of flowmeters, and other similar uses. The gage has been shown to possess excellent stability against corrosion by fluorine. The output voltage obtained was 1.7 mV/mm H2O, and drift was less than 0.5 mm H2O. The gage can be used for control of fluorine disposal by absorption in a wide range of mean flow rates, and dispenses with the use of fluorine-resistant control valves.

5318 APTIC NUMBER 18692

Tuerkoelmez, S.
NEW METHOD FOR WASTE GAS CLEANING. ELIMINATION OF ODORS BY EXCHANGE ADSORPTION WITH ARTIFICIAL RESIN ION EXCHANGERS. PART

T. (Neues Verfahren der Abgasreinigung. Beseitigung der Geruchbelaestigungen durch Austausch-Adsorption mittels Kunstharz-Ionenaustauschern. Teil I). Text in German. Wasser Luft Betrieb, no. 11:737-743, 1965.

For the removal of odors from industrial waste gases, the use of artificial ion exchanger resins is suggested. The reaction takes place in the gas phase in the case of inorganic waste gases and in the liquid phase for organic compounds. Four types of exchangers, IR-45(OH), IRA-410(OH), IRC-50(H), and IR-120(H), were successfully tested with phenols, mercaptans, bromides, fluorides, cyanides, nitriles, chlorides, SO2, and a number of organic compounds. Fluorides, cyanides, chlorides, and SO2 could be completely removed. Pre-adsorption with alkaline earth hydroxides in scrubbers was used only in the case of phenols.

5319 APTIC NUMBER 13769

Turk, Amos
CATALYTIC REACTIVATION OF ACTIVATED CARBON IN AIR PURIFICATION SYSTEMS. Ind. Eng. Chem., 47(5):966-971, May 1955. 9 refs.

Adsorption of organic vapors by activated carbon is a satisfactory method of air purification. A new method is presented for inexpensive reactivation of the adsorbent without the use of superheated steam. The activated carbon is impregnated with a chromic oxide catalyst which does not impair adsorbing properties. When the carbon is saturated, reactivation is effected by warming it in an air stream until the adsorbate is completely oxidized on the catalyst-carbon surface. An activated carbon with high kindling temperature permits quantitative partition in oxidizing all the adsorbate but none of the carbon. Successive reactivations do not alter the distribution of pore diameters of the carbon or diminish its adsorptive capacity. Recycling of the air at the start of the process prevents atmospheric discharge of any desorbed pollutants. Data are given for various sorbates. (Author abstract modified)

5320 APTIC NUMBER 14533

A METHOD FOR THE RECOVERY OF NITROGEN OXIDES. (Werkwijze voor het winnen van stikstofoxyden). Text in Dutch. (Universal Oil Products Co., Des Plaines, Ill.) Dutch Pat. 6,607,036. 13p., Nov. 25, 1966. (Appl. May 23, 1966, 8 claims).

The system is particularly suited to handling tail gases from a nitric acid factory and from the lead chamber process of a sulfuric acid factory. This method also gives a distinct improvement in the output of a nitric acid plant. The waste gas is passed over a bed of adsorbing coal particles followed by a hot fluid desorption medium to remove the adsorbed nitrogen oxides from the particles. The desorption medium consists of steam at about 10 atm at a temperature greater than 157 C and preferably more than 177 C. The nitrogen oxide-containing steam is cooled and the mixture obtained is returned to the adsorption zone of the nitric acid plant. The desorption medium can also be hot air. The depth of the bed should not exceed 0.3m to prevent a large pressure drop. The stream waste gas through the adsorption bed is diverted upon saturation with nitrogen oxides to another bed of adsorbing coal. The coal in the first bed is then desorbed until the second bed is saturated and the cycle is repeated. Waste gas from sulfuric acid plants is treated the same way. The advantages of this method are better removal of nitrogen oxides with cost reduction, since no extra fuel is required. Due to integration of the units for preparation of acid and for recovery, higher output is obtained; output of a nitric acid plant can be increased by 5% by more complete use of NO2.

5321 APTIC NUMBER 15892

Ungalis, A.
NATURAL GAS AS FUEL FOR INDUSTRIAL PLANTS. (Erdgas als Brennstoff fuer Industrieanlagen). Text in German. Brennstoff-Waerme-Kraft, 21(11):568-571, Nov. 1969. 3 refs.

The composition is given of natural gas from Cap Bon, Africa (contains no sulfur compounds); Lacq, France (9.7% CO2, 15.3% H2S); Bierwang, Ampfing, and Isen, West Germany; Lombardy, Italy; the North Sea; and Groningen, The Netherlands. Various methods of removing H2S and CO2 are briefly outlined. The amine method uses monoethanolamine and diethanolamine as absorbents. The glycol-amine method operates with monoethanol amine and diethanol amine glycol to remove the acid gases and the water vapor simultaneously. However, this increases corrosion and contaminates catalysts and thus large quantities of acid gases cannot be economically treated with this method. As alternations, the alkali carbonate, Giammarco-Vetrocoke, and fluorine methods were developed. The first method was developed by the Bureau of Mines (no description is given). The Giammarco-Vetrocoke method uses an alkaline solution containing organic and inorganic components as absorbent. In the fluorine method, the dirty gas rises countercurrent to the absorbing solution to the top of an absorption tower; by depressurizing the solvent the absorbed gases are liberated again and the solution can be returned to the absorption tower. The combustion products of various types of natural gases are listed in a table.

5322 APTIC NUMBER 15957

Val'dberg, A. Yu., N. N. Zaytsev, and V. Yu. Padva
APPLICATION OF SIMILITUDE THEORY TO EXPERIMENTAL STUDY AND DESIGN OF CYCLONE APPARATUS. (Primeneniye teorii podobiya pri eksperimental'nykh issledovaniyakh i konstruirovanii tsiklonnykh apparatov). Text in Russian. Khim. i Neft. Mashinostr., no. 3: 7-8, 1968. 9 refs.

Similitude theory was applied to a number of existing Soviet cyclones. It was established from dependences of the coefficient of incompleteness of dust removal that operation at high gas velocity and small working diameter is most desirable and that cyclone efficiency is best improved by reducing the diameter. With a constant coefficient of hydraulic resistance, the efficiency of the various cyclones was greater the higher the

Euler number. An expression is given which permits evaluating the relationship of various design elements to establish optimum values in terms of both trapping efficiency and hydraulic drag.

5323 APTIC NUMBER 14481

Van Der Drift, J.
CATALYTIC REMOVAL OF NITROGEN OXIDES FROM WASTE GASES OF NITRIC ACID PLANTS. A METHOD FOR THE PREVENTION OF AIR POLLUTION. (Katalytische verwijdering van N-oxyden uit afgewerkte gassen van salpeterzuurfabrieken. Een methode voor de bestrijding van luchtverontreiniging). Text in Dutch. Chem. Tech. (Amsterdam), 20(10):301-305, 1969. 11 refs.

Removal of nitrogen oxides from nitric acid plants can be achieved by catalytic decomposition or reduction. The catalytic decomposition follows the reaction 2NO yields N2 plus O2. With a copper-silica gel catalyst, the nitrogen oxide content of waste gas was reduced from 892 to 277 ppm at 510 C. The reduction method uses hydrogen, natural gas, or ammonia as reducing agents. Various installations for the removal of nitrogen oxides from waste gases are described. A heat exchanger is used to lower the temperature of waste gases from around 515 C to 300 C after reduction. Several commercial catalysts are described. In an experiment using Honeycombgrid HCM-S-900 and ammonia, waste gas of 100,000 vol/vol catalyst/hr containing 0.3% nitrogen oxides and 3% O2 (inlet temp. 286 C) was reduced to 50 ppm NO2 and 86 ppm NO plus NO2. Using 0.3% Pt on a Torvex ceramic honeycomb and natural gas, waste gas of 100,000 vol/vol catalyst/hr containing 0.3% nitrogen oxides and 2.58% O2 (inlet temp. 480 C) was reduced to 58 ppm nitrogen oxides.

5324 APTIC NUMBER 13771

Varlamov, M. L., P. L. Krichevskaya, A. A. Fenan, L. M. Zaapol'skaya, G. A. Manakin, and M. A. Georgalin
ACOUSTIC COAGULATION OF MIST CONTAINING FLUORINE COMPOUNDS. J. Appl. Chem. USSR (English Transl.), 41(12):2494-2499, Dec. 1968. 8 refs.

Investigations of the particle-number concentrations and size distributions in mist containing fluorine compounds were conducted with a flow ultramicroscope and photomicrography under laboratory and plant conditions before and after acoustic treatment. The results of these studies showed that the number of particles decreases by a factor of 100-1000 as a result of acoustic treatment for 1 to 5 sec. Examination of the experimental data obtained in studies of the particle-size distribution of aqueous mist showed that the minimum size of the drops was 0.9 micron and the greatest frequency was in the 5 to 6 micron range. In the case of industrial mist, the number of particles deposited per unit area is decreased by a factor of 125 after acoustic treatment for 1.5 sec, while the average diameter increases from 2.5 to 18.7 microns. Before treatment, 88% of the particles were in the 1 to 8 micron range. Acoustic treatment shifts the distribution to the right and increases the variance. (Author conclusions modified)

5325 APTIC NUMBER 14633

Varshavskiy, Y. L., L. S. Zolotarevskiy, and A. I. Frenkel'
ON THE LIBERATION OF NITROGEN OXIDES IN ENGINES WITH EXTERNAL CARBURETION OPERATING ON FUEL GASES. (O vydelenii okislov azota v dvigatelyakh s vneshnim smeseobrazovaniyem, ispol'zuyushchikh gazovoye toplivo). Text in Russian. Gaz. Prom., 11(7):36-39, 1966. 6 refs.

It was experimentally confirmed that the principle pollutants from engines operating on fuel gases with lean mixtures are nitrogen oxides. There are two approaches to the reduction of these pollutants: shift to a richer mixture (alpha less than 0.9) or to a leaner mixture (alpha greater than 1.35); the first being used only in special cases because of the resultant high fuel consumption rate. Adjustment to give minimum yield of nitrogen oxides requires a leaner mixture than is possible for gasoline-operated engines. The use of fuel gases for automobiles operating in large cities is seen as a possible prospect.

5326 APTIC NUMBER 14851

Westal, Marvin L., Allan G. Day, III, J. S. Snyderman, Gordon J. Fergusson, F. W. Lampe, R. M. Essenhigh, and W. H. Johnson
KINETIC STUDIES ON THE PYROLYSIS, DESULFURIZATION, & GASIFICATION OF COALS WITH EMPHASIS ON THE NON-ISOTHERMAL KINETIC METHOD. Scientific Research Instruments Corp., Baltimore, Md., Contract PH 86-68-65, Rept. SRIC 68-13, 111p., Sept. 1968. 29 refs.
CFSTI: PB 185 882

The theory of the non-isothermal technique developed by Juntgen and co-workers for the study of the kinetics of complex heterogeneous reactions was extended to include reactive flush gases and back reactions of the products, and was applied to experimental studies of pyrolysis, desulfurization, and gasification of coals in a series of 23 non-isothermal experiments. In addition, facilities were constructed for isothermal experiments and a series of 19 runs was conducted, utilizing both fast and slow heating rates to reach the isothermal operating temperature. The variables studied included coal particle size, flush-gas composition, gas flow rates, and the forms of sulfur in the coal. It was concluded that the non-isothermal method is a powerful technique for obtaining kinetic data necessary for the development of coal desulfurization processes. The back reaction of H2S with coke is the most important factor limiting the rate and efficiency of desulfurization. Practical desulfurization can possibly be accomplished during pyrolysis and without complete gasification by intimately mixing a suitable sulfur absorbent with the coal in the pyrolyzing reactor. It was also shown that the rate of the slowest desulfurization is sufficiently fast at 750 C and 1 atm of hydrogen that at least 99% desulfurization can be accomplished with a reaction time of 0.5 min. Below about 0.1 mm, the effect of particle size on the

reaction kinetics appeared to be small. Heating rate effects were probably due to the fast back reaction. These conclusions indicated that desulfurization during coal gasification prior to combustion may be feasible and economically practical, provided a suitable sulfur absorbent can be found.

5327 APTIC NUMBER 13691

Vorobev, D. D., V. N. Ilyashenko, M. S. Komarovskii, N. P. Slavgorodskaya, I. Y. Pozhvatovskii, P. N. Kucheryavyi, and P. Y. Shuleshov
THE USE OF QUARTZ FILTERS IN AN AMMONIA PLANT. Coke Chem. (USSR) (English Transl.), No. 8:38-41, 1968.

To be effective the sand particles in a sand filter should be 0.5-1.0 mm and tar particles 5-10 micrometers in size. The linear filtration speed should be about 5 m/hr and the extent of tar accumulation in the filter should not exceed 50 to 60 kg/cu m of sand. The filter washing rate for periodic removal of tar from the sand should be in the range of 15 to 20 l/sq m at a washing temperature of at least 60 C and a consumption equal to three times the volume of the sand charge. Giprokoks designed a quartz filter meeting these requirements for use in removal of coal tar from weak ammoniacal liquors. The filter was used in a number of works and evaluated after four months. The average coal tar content of the liquor was 238 mg/l, and only 14 mg/l remained after filtration. The filter was washed every 48 hr, and 48 kg of tar were removed each time. During the four months, approximately 78,000 cu m of liquor were purified and 17 tons of tar returned to production. Given good filter operating and washing conditions, it is estimated that 95% of the tar can be removed from the liquor in 96 hr if the initial liquor has an average tar content of 200 mg/l. The equation used in determining maximum permissible tar capacity/cu m of sand is given.

5328 APTIC NUMBER 13729

Wada, N.
A PLANT FOR DIRECT DESULPHURATION OF HEAVY OILS. (Une usine de desulfuration directe des huiles lourdes). Text in French. Chim. Ind. (Paris), 101(1):25-30, Jan. 1969.

The high consumption of electric power and the concentration of industries make the problem of air pollution by sulfur dioxide particularly acute in Japan. Methods envisaged for the reduction of the sulfur content of heavy oils are described, and direct and indirect desulfurization processes are compared. Special attention is given to the economics of and the results obtained by the desulfurization unit installed at the Chiba refinery. (Author abstract modified)

5329 APTIC NUMBER 14809

Wagner, T. O.
PRACTICALITY OF STEAM-POWERED AUTOMOBILES. Proc. Am. Petrol. Inst., Sect. VIII, vol. 49:328-353, 1969. 27 refs.

Building a steam-powered automobile of tolerable cost and reliability that would be operable in current traffic patterns would not require large advances in technology, but it would require a major program of engineering development. Even without special attention to them, emissions of hydrocarbons and carbon monoxide would be less than allowed in the 1970 federal exhaust emission standards. The car would not require a transmission, and once it was warmed, operation would be smooth, simple, and quiet. However, the steam generator and its control system would need to have high capacity and fast response, and attaining quick warm-up would undoubtedly compromise performance. Recovery of all of the exhaust steam in a bulky condenser would be essential. Because of freezing problems, some compound other than water would need to be used as the working fluid. Power to operate auxiliaries of the steam system and accessories of the car would need to be obtained from an auxiliary engine because the propulsion engine would not idle as a conventional engine does when the car is stopped. Lubrication of the engine would be a problem. The car could use a wide range of fuels, but fuel consumption would be higher than that of a car with a gasoline engine. Certain disabilities are inherent in a vapor-power system. The technology of steam power is already highly developed, and except for improvements in control systems and material-fabrication procedures, it is doubtful if even intensive research would provide major advances in the performance of a steam car. While a steam-powered car would be a serviceable alternative to a car powered with a conventional engine, it would not be a highly desirable one. (Author abstract modified)

5330 APTIC NUMBER 14547

Wahnschaffe, E.
DESULFURIZATION OF FLUE GASES ACCORDING TO THE REINLUFT PROCESS. (Entschwefelung der Rauchgase nach dem Reinluftverfahren). Text in German. Mitt. Ver. Grosskesselbesitzer, vol. 83:72-74, April 1963.

In the Volkswagen factory in Wolfsburg, West Germany, desulfurization experiments were conducted from January to March and August to November 1959. The desulfurization equipment was designed for a cleaning capacity of 1000 to 2000 cu m/hr of flue gas from a fuel oil-fired boiler furnace. The flue gas was taken from the air preheater at a temperature of 200 C. The desulfurization equipment consisted of a pre-cooler, a cooler, the adsorber containing semicoke, the desorber where the sulfur bound as sulfuric acid is liberated from the coke, a discharge and sifting station, and a bucket which returns the semicoke to the adsorber bunker. The adsorption rates obtained by the experiments showed that any desired degree of purity can be obtained with the proper equipment. Adsorption of SO2 took place at temperatures from 70 to 160 C. Above 160 C, the cleaning efficiency drops markedly, while SO3 can still be adsorbed rapidly and completely up to 250 C. Costs for the catalyst amounted to 30 to 50% of the current operating costs. Part of the catalyst is consumed in the oxidation of SO2 and part is lost by the constant movement of the catalyst counter-current to the gas flow. The catalyst was reactivated at temperatures from 380 to 450 C, where all but 0.5% of SO2 could be removed. The equipment was

made of steel, but those parts subjected to temperatures below the water dew point corroded rapidly. However, in spite of this flaw, it can be said that the Reinluft process has passed the development stage and is ready for practical use.

5331 APTIC NUMBER 15398

Wal, J. R. van der
THE FILTRATION OF AEROSOLS BY GLASS FIBRE FILTERS. II. INFLUENCE OF THE LINEAR FLOW VELOCITY, THE AEROSOL LOAD, THE FILTER POROSITY AND THE AEROSOL MATERIAL. (De filtratie van aerosolen door glasvezelfilters. II. De invloed van de doorvoersnelheid, de belading, de porositeit van het filter en de aerosolstof op de penetratie). Text in Dutch. National Defense Research Organization TNO, Rijswijk, Netherlands, Chemical Lab., Report 1968-18, 15p., Sept. 1968. 7 refs.

Parameters influencing the penetration of aerosols through fiberglass filters were investigated. Results show that the penetration decreases as linear flow velocity decreases in the 0.1-1.0 cm/sec range. The influence of aerosol load on glass fiber filters is more pronounced for solid particles than for liquid particles with regard to penetration and air flow resistance. No close relationship between filter thickness and porosity and aerosol penetration was established, but penetration was found to be influenced by the chemical composition of the aerosol. (Author summary modified)

5332 APTIC NUMBER 14403

Warnick, Philip
SMUDGE COLLECTOR. (Assignee not given.) U. S. Pat. 3,458,178. 2p., July 29, 1969. 5 refs. (Appl. March 20, 1967, 1 claim).

An apparatus for removing smudge particles from exhaust gases flowing upward through a chimney is described. The apparatus consists of an inverted hollow cone having a series of screens and a water spray positioned above the screens to direct water downward through the screens to wash collected particles. Below the bottom of the cone a means is provided for collecting particles and water. A gas inlet and outlet, each having a damper, connects the chimney to the cone. The screens have graduated openings with the opening size decreasing with increasing screen elevation. The gas inlet has a water trap for preventing water from flowing through. A fan is positioned in the chimney above the gas inlet for drawing fumes through the chimney. Means are provided for vibrating the screens to remove particles from them and the exhaust gas is fed into the cone below the screens. Thus, the particles are removed from the exhaust gases before these gases are returned to the chimney at a point higher than that from which they were taken.

5333 APTIC NUMBER 14459

Weaver, E. E.
EFFECTS OF TETRAETHYL LEAD ON CATALYST LIFE AND EFFICIENCY IN CUSTOMER TYPE VEHICLE OPERATION. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 18 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690180.)

Effects of four levels of tetraethyl lead (TEL) on the efficiency and life of a commercially available hydrocarbon and carbon monoxide catalyst were investigated. The four fuels used in mileage accumulation were the base Indolene with no added lead and blends containing respectively 0.5, 1.5, and 3.0 ml TEL per gallon. The vehicles were eight Fords equipped with 289-CID non-emission controlled 2-V engines, unmodified except for a lean carburetor and the catalytic exhaust system. The eight vehicles were paired off and each pair operated on one of the four fuel blends. In each pair, a radial flow converter, which required no supplemental air, was located under the front seat in one vehicle and near the rear axle in the other vehicle. Exhaust emissions were monitored at approximately 3000-mile intervals during accumulation of 18,000 miles in customer-type service. Tetraethyl lead in the fuel adversely affected the rate of warm up, the ability of the catalyst to remove hydrocarbons from the exhaust, and accentuated the differences in performance between front and rear converters as mileage was accumulated. On non-lead fuel, the catalyst performed well in preferentially removing olefins and aromatic hydrocarbons to yeild an exhaust of very low reactivity, until problems were encountered with losses of catalyst. The catalyst removed CO, aliphatic aldehydes, and acetylenes equally well on leaded or non-leaded fuel. (Author abstract modified)

5334 APTIC NUMBER 14287

Weber, Ekkehard
YEARLY REVIEW OF CLEAN AIR MAINTENANCE. (57TH SERIES). (Jahresuebersicht Reinhaltung der Luft (5. Folge)). Text in German. Giesserei (Duesseldorf), 56(12):372-377, June 5, 1969. 88 refs.

Beginning with a list of books concerned with the legal implications of air pollution, all publications in this field from 1966 to 1968 are listed and briefly described. Major categories discussed are gas and dust yield and dust technology; dust and gas separation methods; dust removal equipment, including wet and dry mechanical separators, electrofilters, and fabric filters; and pollution measurement methods. For 20 years, W. C. McCrone, P. G. Draftz, and J. G. Delly collected microphotographs of various dust particles to prepare an atlas which is limited to particles larger than 1 micrometer. J. Jochem found that centrifugal forces between 9000 and 42,000 g develop in wet cyclones and bring about close contact of the dust with the scrubbing liquid. S. P. Babson reported a vortex scrubber with high collection efficiency and low pressure loss. B. Bohlen, J. Luthi, and A. Guyer reported on a new method of electrostatic precipitation in which plate-type auxiliary electrodes are installed in addition to the ionizing and collection electrodes; the plate electrodes are arranged in parallel to the collection electrodes. High-efficiency collection was achieved, even at high specific dust resistance. With a two-stage electrostatic precipitator, the 'NIK-TP', developed by a Japanese firm, a collection efficiency of 97% was obtained at an air velocity of

1.8 cm/sec and a pressure loss of 7 mm H2O. R. H. Borgwardt, R. E. Harrington, and D. W. Spaite described results of experiments with glass fiber filters used at a coal dust-fired furnace. The filters retained gases, particularly SO3, as well as fly ash.

5335 APTIC NUMBER 15147

Wehmeier, Werner and Hans Weineck
STRUCTURE AND ORGANISATION OF A SPECIAL DEPARTMENT FOR COMBATING AIR POLLUTION. (Aufbau und Einrichtung einer Fachabteilung Reinhaltung der Luft). Text in German. Stahl Eisen, 89(20):1089-1091, Oct. 1969. 11 refs.

Although West German iron and steel production has increased, pollutant emissions have been reduced. This is due to the extensive measurement programs undertaken by various industrial complexes and to the installation of waste-gas cleaning systems. Special departments are staffed with experts soley concerned with air pollution problems. As an example of the work rendered by such departments, the air pollution department of a metallurgical plant is described. Emissions are continuously monitored. For these measurements photoelectric measuring units are increasingly used. Sulfur dioxide emissions are measured by automatically recording units based on the principle of changing the electric conductivity of a standard liquid. Seventeen Bergerhoff units are located throughout the plant to measure the dust fall. A measuring station continuously measures atmospheric SO2 concentration. Meteorological measurements and observations are currently under way, as are measurements of the plant concentrations. A mobile measuring station is used both for emission and air quality measurements. Dust measurements showed that by 1968 the dust concentration in the atmosphere surrounding the plant had dropped to one fifth of the concentration measured in 1956. The lowest SO2 concentrations are always measured during warm weather, the highest in cold weather. This is explained by the fact that at temperatures below 10 C, home heating systems are activated and begin to discharge SO2.

5336 APTIC NUMBER 15022

Weller, Sol and Waldo A. Steiner
SEPARATION OF GASES BY FRACTIONAL PERMEATION THROUGH MEMBRANES. J. Appl. Phys., 21(8):279-283, April 1950. 9 refs.

The permeability of a number of thin organic films toward oxygen and nitrogen was measured, using a small Seitz bacterial filter modified to hold the sample of film which was supported on one side by filter paper backed by 30-mesh wire screen. For an ethyl cellulose film the studies were extended to include several other gases. For each gas, the permeability increased with increasing temperature. The temperature (and therefore the activation energy for permeation) was about the same for O2, He, and H2 but was greater for N2. For the enrichment of air, a compromise has to be established between the use of higher temperatures to obtain higher permeability, and lower temperatures to obtain higher selectivity. The enrichment of binary gas mixture in a single stage of permeation was calculated for the extreme cases of perfect mixing and no mixing. Application of these results indicated that a fractional permeation process may be of practical importance in effecting the separation of oxygen from air, helium from natural gas, and hydrogen from coke-oven gas. (Author abstract modified)

5337 APTIC NUMBER 14614

Wickert, K.
DESULPHURIZATION EXPERIMENTS BEFORE AND AFTER THE BURNER TO REDUCE SO2 EMISSION. (Versuche zur Entschwefelung vor und hinter dem Brenner zur Verringerung des SO2 -Auswurfs). Text in German. Mitt. Ver. Grosskesselbesitzer, vol. 83:74-82, April 1963. 1 ref.

Dolomite hydrate of an amount equivalent to the sulfur content of the fuel oil was injected into a 20 ton/hr furnace perpendicularly to the burner axis. Desulfurization of the combustion gases fluctuated at standard load between 10 and 15%. When the furnace was operated at just one-third of its normal load, desulfurization rose to between 40 and 45%. The experiments showed that by tripling the residence time of the combustion gases, the degree of desulfurization likewise rose threefold. Since the dolomite hydrate was injected at just one point, it was assumed that better distribution of the adsorbent would lead to complete desulfurization in operations below the normal load. Unfortunately, this assumption could not be verified by experiments. It was concluded that a residence time of 2 sec at full load and 6 sec at one-third load and good distribution of the adsorbent in the reaction chamber will bring satisfactory desulfurization. In the power plant of the Volkswagen factory in Wolfburg, further desulfurization experiments were conducted on a 143 t/hr boiler furnace burning fuel with 0.9% sulfur. Dolomite hydrate was injected above the burner. Dolomite dust was injected by four nozzles parallel to the burner axis and perpendicularly to the deflected flue gas flow. The residence time of the flue gases amounted to at least 6 sec. Satisfactory desulfurization was achieved. The same can be said about similar desulfurization experiments ahead of the burner.

5338 APTIC NUMBER 15681

Willet, Howard P. and Daniel P. Pike
THE VENTURI SCRUBBER FOR CLEANING OXYGEN. Iron Steel Engr., 38(7):126-131, July 1961. 7 refs.

The requirements of a venturi gas cleaning system for an oxygen steel plant are discussed. The hood over the furnace is a vital part of the system, dictating to a large extent capacity requirements. The hood should be arranged so that a controlled or limited amount of air is induced for combustion purposes. However, it is not essential to burn all the CO evolved, since a wet system can tolerate a considerable amount of CO without danger of explosion. Equations are presented for calculating combustion with no excess air; for 50% excess air, 150% combustion air; and for 50% combustion air. The cleaning

efficiency of a venturi is a function of the available pressure drop. To determine the efficiency and outlet concentration, several items must be considered: present and future air pollution codes, proximity of residential areas, and meteorological conditions. For a clean stack appearance, the concentration should be limited to 0.05 grain/std cu ft, dry. This requires a pressure drop of 40-in. water column for scrubbing. Power consumption requirements are about 970 hp (724 kw). Water consumption can be minimized by use of a water recirculation system. The sludge in which the collected dust leaves the scrubber can be treated in a thickener with other wastes if recovery is not desired. It can also be centrifuged and returned to the circulation system or treated with a thickner and filter to give a cake containing 25% water.

5339 APTIC NUMBER 13765

Williamson, Donald
POLLUTION CONTROL EQUIPMENT - THE NEW SYSTEMS. Foundry, 96(9): 86-91, Sept. 1968.

The systems available for controlling air pollution are wet collectors, dry or fabric collectors, centrifugal separators, and electrostatic collectors. Manufacturers stress the smaller size and lower initial cost involved in wet systems; dry systems are noted for their relatively low operating cost, the absence of a steam plume from the stack, and the absence of water treatment. In-plant ventilation is an example of control equipment designed for highly specialized types of service. Mobile exhaust systems capture and exhaust pollutants from ladles and furnaces with a small volume of air. Collectors are small, economical, and custom designed. Several systems are being designed to help lower maintenance costs, such as a scrubber with no spray nozzle and no moving parts. Investigators are exploring such uses as land fill, building products, fillers, colorants, agricultural, and masonry uses for foundry wastes. The main problem is one of financing, since the industries rarely receive financial assistance when purchasing expensive pollution control equipment.

5340 APTIC NUMBER 15151

Winkler, Heinrich
DEVICE FOR VOLTAGE REGULATION OF AN ELECTROSTATIC PRECIPITATOR. (Einrichtung zum Regeln der Spannung eines Elektrofilters). Text in German. (Siemens A. G., Munich, West Germany) Swiss Pat. 470,205. 3p., March 31, 1969. (Appl. Nov. 29, 1966).

A device for voltage regulation of an electrostatic precipitator was devised which is supplied from a.c. mains via a high-voltage transformer and a high-voltage rectifier. The controlling element is a magnetic amplifier in the primary of the high-voltage transformer. The magnetic amplifier is controlled by a pair of thyristors, whose conduction angle is determined by the voltage on a capacitor. This in turn is controlled either by a Schmitt trigger or by a monostable trigger. The Schmitt trigger senses the difference between a regulated reference voltage and the rectified and smoothed control voltage derived from a current transformer located in the primary of the high-voltage transformer. An increase of the primary current activates the Schmitt trigger, which decreases via the above-mentioned capacitor, the conduction angle of the thyristors. Transient overcurrents are sensed via a differentiation capacitor by the monostable trigger whose output acts on the thyristors.

5341 APTIC NUMBER 13739

Winter, Ramsay Middleton and Herbert Brereton Baker
THE EFFECT OF HEATING ON THE ABSORPTIVE POWER OF SUGAR-CHARCOAL FOR SULPHUR DIOXIDE. J. Chem. Soc., vol. 117:319-320, 1920.

It was shown that wood-charcoal which had been subjected to long-continued heating gained so much absorptive power that it was no longer considered inferior to animal-charcoal. This finding was investigated further to determine whether the increase in absorptive power was associated with any other changes in the physical properties of the charcoal. The purest sugar-charcoal obtainable was used in particles between 0.6 and 0.8 mm in diameter. Its specific gravity was increased, after 40 hours of heating to 900 deg, from 1.76 to 1.84. By the same treatment the amount of sulfur dioxide absorbed was increased from 97 c.c. to 288 c.c. It was suggested that this investigation be extended to cases of other gases, and also to find if other physical properties of charcoal are affected by prolonged heating.

5342 APTIC NUMBER 13747

Wisting, Walter L.
GAS TREATING APPARATUS AND METHOD. (Wallace-Murray Corp., New York) U. S. Pat. 3,448,562. 9p., June 10, 1969. 7 refs. (Appl. July 25, 1967, 18 claims).

A device for removing contaminants from air or a gas using a wetting agent is described. This device consists of a conduit with a central portion of a smaller diameter than the rest, and with contoured walls. The contaminated air is drawn into the conduit and passes through a conical spray of water so that the air is exposed to a washing or scrubbing action. Due to the construction and arrangement of the conduit, the single spray nozzle produces three screens of water. This increases the length of time that the particles are retained, and thus, produces a more efficient wetting of airborne contaminants. Some of the wetted particles are collected on a screen, and the smaller ones pass through the screen to the water in a reservoir. The wetted contaminant particles, being heavier than air, do not change direction with the air stream and are collected in the water of the reservoir.

5343 APTIC NUMBER 10805

Withorn, Benjamin
COMBUSTION APPARATUS. U. S. Pat. 3,456,606. 4p., July 22, 1969. 3 refs. (Appl. July 10, 1967, 1 claim).

The patent discloses an arrangement of parts which can be easily installed in an existing smoke stack or stack flue. It can be adapted to sprinkle either a steam or a fine mist of water against the rising flue gases in order to mingle with them and cause the soot particles to become heavier by the addition of the steam or water mist. This causes rapid precipitation of the gases within the stack, thus preventing their escape into the surrounding atmosphere. Also, the addition of steam to the rising combustion gases changes their color from dark to gray or white. (Author abstract modified)

5344 APTIC NUMBER 15252

Wolf, Herbert
METHOD FOR REMOVING SULFUR DIOXIDE FROM WASTE GASES. (Verfahren zur Entfernung von Schwefeldioxyd aus Abgasen). Text in German. (Badische Anilin-& Soda-Fabrik, AG, Ludwigshafen/Rhine) W. German Pat. 1,208,770. 8p., Nov. 11, 1965. 1 ref. (Appl. July 3, 1963, 5 claims).

A method for the removal of SO2 from waste gases is characterized by a scrubbing process of two or more stages. Sulfuric acid in which selenious acid is dissolved is used as scrubbing fluid. Elementary selenium which forms in the process is removed, oxidized to selenium dioxide with oxygen, or oxygen-containing gases, and recirculated. The sulfuric acid formed from SO2 is removed from circulation and replenished by an aliquot amount of water. Flow velocities of up to 3.5 m/sec are used. Reaction takes place according to the equation 2SO2 + SeO2 + 2H2O yields Se + 2H2SO4. For a better understanding of the process, a practical example is given. Waste gas (360 liters) with 0.2% by volume SO2 was drawn through a venturi scrubber at 3.5 m/sec. Simultaneously, 1.3 liter of 30% sulfuric acid in which 2.5% by weight SeO2 was dissolved was circulated. After separation of the fluid from the gas the latter contained dust 0.021% by volume SO2, i.e., 89.5% of the initially present SO2 had been oxidized to sulfuric acid. In thy process 3.25 g elementary selenium was obtained. The sulfuric acid content of the circulating fluid increased by 5.75 g. In the second stage the SO2 content was reduced to 0.14% by volume.

5345 APTIC NUMBER 14375

Wolowski, Eckard and Herbert Wovna
PRESSURE DROP AND EFFICIENCY OF LONG-DISTANCE GAS-DUST FILTERS. (Druckverlust und Wirkungsgrad von Ferngas-Staubfiltern). Text in German. Gas Wasserfach (Munich), 109(31):881-851, Aug. 2, 1968. 9 refs.

Legal regulations require the cleansing of dust-laden gases ahead of gas pressure regulators to prevent malfunction of the equipment. For this purpose, dust filters are installed. The efficiency and pressure loss of Aerolith dust filters (trade name for a ceramic silicate mixture rich in silicic acid), Filtroplast PP filters (a combination of organic fibers with plastic polyolefinic material), Pafic filters (consisting of non-felting glass fibers which are resistant to chemical and impregnated with phenolic resin), and Sipers B (porous tin-bronze) dust filters were tested with coking gas at pressures of 1, 2, and 3 atm. The pressure loss was determined for new, cleaned, and dirty filters with a U-tube manometer. The dirty state was defined by the type and quantity of the supplied dust. The efficiency of the filter media was obtained from the quotient of the retained dust to the supplied dust. In all filters, a non-linear increase of the pressure loss with the throughput was observed, which was dependent on the pressure. At constant throughput, the pressure loss did not increase with the quantity of dust supplied. Collection efficiencies of 94.9 to 97.0% for the Aerolith filter, 95.1 to 95.8% for the Filtroplast PP filter, better than 99.93% for the Sipers B filter were obtained. With the Pafic filter, a collection efficiency of 90.4% was obtained in the new state. This was reduced to 84.0% in the cleaned state. The pressure loss measurements were reproducible by application of Hagen-Poiseuille's law and the square resistance law, so that it was feasible to get an idea of what the conditions would be like at higher static pressures. It was found that at constant pressure loss, the allowable filtered dust quantity becomes smaller with increasing pressure.

5346 APTIC NUMBER 14522

Woodruff, P. H. and G. P. Larson
COMBUSTION PROFILE OF A GRATE-ROTARY KILN INCINERATOR. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 327-336. (May 5-8).

Tests were conducted on a 300 t/per day grate-rotary kiln incinerator to establish criteria for design modifications and to determine operational procedures necessary to comply with air pollution regulations and to reduce nuisance complaints. Samples of oxygen, carbon monoxide, and carbon dioxide were collected at the end of the rotary kiln, in the secondary combustion chamber, the area in front of the water sprays, and in the stack. Temperatures and velocities of the gas stream, plus particulate loading to the incinerator, were also determined. Organic constituents found in the secondary combustion chamber indicate that combustion is not always complete before the gas stream reaches the water sprays. Air under grates promotes suspension of excessive amounts of particulates in the gas stream, while outside air drawn into the ash pit produces turbulent conditions preventing deposition of lighter ash particles in the pit. In addition, the startup period is excessive. Proposals are made for operating the incinerator on a seven-day basis, installing burners in the primary and secondary burning zones, reducing infiltrated air, and installing baffles across the secondary combustion chamber.

5347 APTIC NUMBER 14739

PRACTICAL ASPECTS OF GRIT EMISSION. Works Eng. Factory Serv., 68(758):6-8, April 1969.

Identification, amelioration, and collection of grit emission are discussed. The origin of solid particulate matter falling from an industrial chimney may be difficult to identify. A chimney in an industrial area may be blamed, although the chimney

makes no contribution to grit emission. Conversely, a chimney emitting a considerable quantity of grit which is virtually invisible may escape responsibility altogether. Very fine particles travel such a distance before they fall that nobody notices them. Financial considerations loom large in the amelioration of grit emission. Heavy expenditure may not result in any increased efficiency or reduction in fuel consumption. Large particles falling near the chimney are relatively easily caught, but trapping fine dust is more difficult. For small installations, grit may be separated by reducing the velocity of the flue gas stream through a settling chamber designed so that the gas velocity falls to 1-10 ft/sec. The efficiency of a grit arrester is sometimes expressed as a percentage efficiency of grit extraction, but this does not present a satisfactory characteristic. What matters is the percentage of inefficiency, the amount of grit escaping into the atmosphere, and its sizing. Whatever the efficiency characteristics of a particular system, it may generally be assumed that a higher efficiency can be achieved. A high proportion of the finest particles may be caught, providing the cost of achieving the result is acceptable in terms of induced draught, increasing chimney height, or the introduction of supplementary treatment.

5348 APTIC NUMBER 15306

Wright, William R.
METHOD AND APPARATUS FOR PREVENTING CONDENSATION IN A COLLECTION SYSTEM. (Ashland & Refining Co., Inc., Houston, Tex.) U. S. Pat. 3,468,108. 6p., Sept. 1969. 3 refs. (Appl. June 21, 1965, 8 claims).

To improve present methods and apparatus for the starting up and shutting down of a carbon black producing system, a collection system was devised for separating solids from hot, moisture-laden gases; the system is equipped with apparatus for causing heated gases of relatively low moisture content to circulate through it either before the hot moisture-laden gases are introduced or to purge the system of these moisture-laden gases before shutdown. The process has the added advantages of permitting startup and shutdown to take place without condensation occurring on the internal surfaces of the collection system, thereby greatly reducing corrosion of the internal metal part; of extending the life of the filter bag by eliminating wetting of the fabric; and of greatly reducing the time necessary for starting up a producing system. The production apparatus consisting of at least one furnace-type carbon black reactor, or a collection system for separating the carbon black and hot combustion gases, and quenching, flow-inducing, and heater mechanisms connected with the collection system, is described in detail and a practical example of its operation is given.

5349 APTIC NUMBER 10353

Yagi, Shizuo, Fazuo Wakagawa, Akira Ishizuya, and Yasuhito Sato
A STUDY IN THE DEVELOPMENT OF EXHAUST EMISSION CONTROLS FOR SMALL DISPLACEMENT HONDA ENGINES. Preprint, Society of Automotive Engineers, Inc., New York, 20p., 1968. 11 refs. (Presented at the West Coast Meeting, Society of Automotive Engineers, San Francisco, Aug. 12-15, 1968, Paper 680527.)

In the small displacement, high-speed, high-performance spark ignition engines being developed by Honda, the difficulties in reducing exhaust emissions without seriously impairing inherent engine characteristics are different from those encountered with the large displacement engines generally used in American cars. The tandem throttle valve system was developed as a control device to minimize exhausts emissions during the frequent accelerations and decelerations in normal driving conditions. The system serves to restrict the flow of fuel from the low-speed system of the carburetor, to prevent fuel remaining on the intake manifold wall from flowing into the cylinders, and to aid the fuel not restricted from flowing into cylinders to burn completely by adding secondary air. The application of an air injection reactor system in small displacement engines reduced carbon monoxide and hydrocarbon concentrations. The effect of 'squish action' in a hemispherical combustion chamber on exhaust emissions promotes better mixing of the gases, thereby increasing the flame speed and resulting in more complete combustion in the cylinder. Through research and development, many of the difficulties were overcome, and satisfactory results were obtained in exhaust emission control under certain limited operating conditions.

5350 APTIC NUMBER 15095

Yamada, Takeshi
R & D ON REMOVAL OF SULFUR OXIDES FROM FLUE GASES IN THE WORLD. (Haigasu datsuryu gijutsu kenkyu kaihatsu no tenbo). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 48(508): 596-602, Aug. 1969. 31 refs.

About 50 methods have been proposed for the removal of sulfur oxides. For the most part they are simple in principle and effective on an experimental scale. For practical use, however, the amount of gas to be processed is too great for the economical operation of these methods. In Japan, the Government has spent about $3.61 million for the development of the active manganese oxide method and active carbon adsorption since 1966. Both of them have been developed to the point of testing of continuous operation at large-scale plants processing gas at the rate of 150,000 cum/hr. They are expected to be used commercially by the end of 1969. Other desulfurization methods being tested include the Kiyoura-T.I.T. method, an absorption method developed by the Kanagawa Prefectural Engineering Station, and calcium carbonate, ammonium, or soda ash blowing methods. Research and developments in the U. S., England, France, and Russia are also reviewed.

5351 APTIC NUMBER 14928

Yamamoto, Toshihiko
DUST COLLECTING AND DESULFURIZING APPARATUS FOR COMBUSTION GAS WITH REVOLVING OBLIQUE BARREL. (Shatokaitenshiki nenshoseiseigasu no tojin datsuryu sochi). Text in Japanese. Kami-pa Gikyoshi (J. Japan. Tech. Assoc. Pulp Paper Ind.) 23(10):423-429, Oct. 1969.

A new device, for which a patent has been applied, simultaneously removes dust and sulfur dioxide in a barrel cooled to 20 to 60 C. Decrease in gas diffusion at low temperatures and gas pressure loss in the barrel are compensated for by the use of a blower. The barrel is filled with pieces of wood, which supply a large wet surface area. Sulfur dioxide is absorbed in circulating water with a minute amount of additive to enhance absorption. The water is either oxidized or neutralized after absorbing SO2. Upon turning the barrel, a large area of cooled surface for absorption is provided by the filler. Rotation of the barrel is also effective. Sulfur dioxide in removing dust from the filler surface and in preventing dust accumulation. The exhaust gas is mixed with fresh air by a blower to a harmless concentration and is released to the atmosphere. The filler material can be removed through openings provided in the barrel. The device has a simple construction and can be easily operated; installation cost is extremely low. The device cannot be used without modification when the combustion gas has a large amount of fly ash. The device is effective in cleaning flue gas from boilers, exhaust gas from public baths or incinerators, and in removal of SO2 from chemical processing plant wastes.

5352 APTIC NUMBER 10948

Yamamoto, A.
PREVENTION MEASURES OF CORROSION OF CHIMNEYS AND FLUES OF HEAVY OIL BURNING BOILERS. (Juyu boira no entotsu oyobi endo no fushoku taisaku). Text in Japanese. Netsu kanri (Heat Management: Energy and Pollution Control), 21(7):19-25, July 1969.

Decrease in weight due to corrosion is greater at the chimney exit than at the entrance with high percentages of excess air. Low-oxygen and low-temperature operation is the key to the prevention of chimney and flue corrosion. Another measure for preventing corrosion is the proper choice of liner materials. Over 50 kinds of metals and non-metals were tested for resistivity to sulfuric acid and high temperature and for mechanical strength. Among gunnite liners, fly ash cement with sand was found to be the best, although its resistivity to acid was limited by the binder. Brick and ceramics were both heat- and sulfuric acid-resistant. For the latter, the higher the density and lesser the void, the better the resistivity. Resin mortar and water glass mortar were the most appropriate as binders. An acid-resistant castable material of the water glass family was excellent in acid resistivity but rather permeable to acid. Plastic liners of fluorine, polyether chloride, or the phenol family proved good, but the latter was most economical. Coatings on gunnite liners were not as effective as those on steel plates. Among metals, lead was the most corrosion-resistant. Steels with high tensile strength were superior to mild steels, but this resistivity varied with composition. An electrical detector of corrosion in liners was developed and proved successful in application to two or three chimneys.

5353 APTIC NUMBER 13774

Young, George, J.

REDUCTION OF SULPHUR DIOXIDE. Eng. Mining J., 131(1):7, Jan. 12, 1931. 1 ref.

J. W. Beckman's method for the reduction of sulfur dioxide to sulfur by carbon monoxide in the presence of a simple catalyst is reviewed. Sulfur dioxide mixed with carbon monoxide was passed through a contact mass at 900-1200 F. Elemental sulfur condensed from the discharged gas. These experiments have not been continued nor have the reaction products been sufficiently determined. However, the ideas are patented in the U. S. and abroad and are of technical interest in reference to SO2 content of smelter smoke.

5354 APTIC NUMBER 15761

Yourt, G. R.
DESIGN PRINCIPLES FOR DUST CONTROL AT MINE CRUSHING AND SCREENING OPERATIONS. Canadian Mining J., 90(10):65-70, Oct. 1969. 13 refs.

In this discussion of design principles the main objective is to confine dusty air, rather than to collect dust. Dust is produced by crushing ore but is dispersed wherever ore falls and gets mixed with air currents. Enclosures are made large and tight-fitting and bypass ducts are used to eliminate surges if necessary. Two types of belt skirting are described. Sufficient air is exhausted to maintain strong indrafts. Steep risers are used to permit low air velocities without clogging pipes and to minimize abrasion and power consumption. Slide-type regulators are installed about 7 ft above floors, bolted or spot welded after balancing system. Cleanouts are installed at elbows in long horizontal runs. Dust collectors are located centrally among dust sources and on upper floors to minimize horizontal runs. Bags are not shakened during operating cycles if possible. Dust is disposed of by slurrying and pumping to the wet grinding section or onto a mill belt within a ventilated enclosure. Floors are cleaned by washing or by use of a industrial standpipe type of vacuum cleaner. A method is illustrated to restrict openings around the tripper at the top of mill bins. (Author summary modified)

5355 APTIC NUMBER 10781

Zalman, Solomon
POLLUTANT TREATING AND ELIMINATING DEVICE. (Assignee not given.) U. S. Pat. 3,462,919. 5p., Aug. 26, 1969. 14 refs. (Appl. May 29, 1967, 3 claims).

A device is described in which a hood is placed over the outlet of a chimney and is ducted to a liquid immersion treating tank. A forced draft system draws in air from the atmosphere through a frontal and a bottom opening in the hood, mixes it with the pollutant-laden exhaust, and positively forces the air exhaust mixture through the liquid treating bath. The shape of construction of the hood is such that, in the event of a failure of the forced draft system, the exhaust is permitted free escape to the atmosphere. The device is said to be in strict accordance with municipal building ordinances which restrict the design, erection, and use of pollution control mechanisms.

5356 APTIC NUMBER 15572

Zawadzki, P. A.
LIMESTONE-BASED PROCESSES FOR CONTROLLING SULFUR DIOXIDE EMISSIONS. Preprint, Illinois Mining Inst., Springfield, 6p., 1969. (Presented at the Illinois Mining Institute Annual Meeting, Springfield, Oct. 9-10, 1969.)

A limestone-based process for control of sulfur dioxide emissions from power plants, based on dry injection, is to be tested at TVA's Shawnee power plant under varying conditions of limestone dispersion, injection temperature, stoichiometry, limestone type, and particle size. A wet scrubbing process will also be tested in the same boiler with some of the same components. Both processes are considered as prime candidates for control of sulfur dioxide emissions due to their versatility and their relatively low capital and operating costs. The wet limestone process will present data on the following: waste disposal and water pollution potential; loss of plume buoyancy; corrosion, solids deposition, and process maintenance; process chemistry and kinetics; and scrubber type. The dry limestone process can be applied to all boilers of 200 MW or lower capacity and less than 30 years old; average capital costs will range from $5 to $8 per kilowatt (1969), and operating costs will average $1.00 to $1.50 per ton of coal. The wet limestone process is applicable to all existing boilers 20 years old or younger; capital costs will range from $9 to $12 per kilowatt, and average operating costs will range from $0.75 to $1.50 per ton of coal.
(Author abstract modified)

5357 APTIC NUMBER 14702

Zizka, J., S. Servus, and Z. Cvrk
NEW EQUIPMENTS FOR THE LIQUIDATION OF HARMFUL SUBSTANCES. (Nova zarizeni na likvidaci exhalacii). Text in Czech. Ochrana Ovzdusi, no. 4:56-59, 1969.

A variety of control devices ranging from separators through absorbers to elastic grid trays was designed and produced by the Research Institution for Chemical Equipment, Chepos, Czechoslovakia. A foam-type separator for the separation of solid and liquid substances operates at atmospheric temperatures as high as 300 C and processes air containing as much as 800 g of solid substances per cu m. A flow-type separator, whose main component is a venturi tube, separates particles less than one micron in size. It is particularly suited to the separation of tar drops from generator gas. The main component of another flow separator is a slot venturi tube permitting an overflow discharge of water. This apparatus can be used to separate highly dispersed solids, liquid emissions, or raw materials with specific characteristics, e.g., textiles. The Triton two-stage wet separator is a high-efficiency separator for extremely fine liquid and solid aerosols. It combines the advantages of foam columns and venturi tubes and is used for deep absorption and direct heat exchange between air and liquid. Gas absorption columns are available in overflow or non-overflow models. Plastic grid trays for absorption and distillation columns represent the most convenient plates for the execution of diffusion processes.

5358 APTIC NUMBER 14837

Zlatin, L. P., A. D. Mamatov, L. A. Kabrin, I. V. Maigov, Yu. D. Yukhnovets, T. D. Varshavskii, P. P. Starke, and N. A. Zhukov
THE SMOKELESS CHARGING OF OVENS. Coke Chem. (USSR) (English transl.), no. 12:12-15, 1968. 3 refs.

A new method was developed for the smokeless charging of coke ovens. The charging gases are sucked into the coke side collecting main only, with the coal blend emptied from the charging car hoppers in a 4, 3, 2, 1 sequence. The high-ash tar that is obtained during charging is collected separately rather than mixed with saleable tar. A technique was developed and adopted for utilizing the high-ash tar to oil the coal blend. The nitrogen oxide content of the saleable gas did not rise, because charging gases pass into a separate pipe system to heat the battery. The satisfactory performance of the smokeless charging system enables it to be recommended for adoption at coke and chemical works supplying coke-oven gas to nitrogenous fertilizer plants. (Author conclusions modified)

5359 APTIC NUMBER 14817

Abel, Nikolaus, Peter Winkler, and Christian Junge
STUDIES OF SIZE DISTRIBUTIONS AND GROWTH WITH HUMIDITY OF NATURAL AEROSOL PARTICLES. PART I. A SENSITIVE LARGE-ION COUNTER FOR STUDYING SIZE DISTRIBUTIONS OF ATMOSPHERIC AEROSOL PARTICLES WITH RADII SMALLER THAN 0.1 MICRON. Max-Planck-Institut fuer Chemie, Mainz, West Germany, Otto-Hahn-Institut, Contract AF 61 (052)-965, AFCRL-69-0205, p. 1-40, Jan. 1969. 17 refs.
AD 689189

A sensitive large-ion counter was improved and tested under field conditions. The instrument and measurements were made at Schauinsland, Germany, the Bay of Biscay, and on Tenerife, Canary Islands, areas of relatively clean air. The result was a large-ion counter which can determine atmospheric aerosol size distributions over the particle size range of 0.000001 cm to 0.00001 cm radius, at particle number concentrations down to about 500/cu cm. In this lower concentration range, the operation of the instrument is rather laborious and the accuracy of the results still unsatisfactory, depending to a large extent on the presence or absence of different environmental perturbations, the influence of which was investigated. The sensitivity that was reached cannot be improved very much with the presently available technique. In order to obtain reliable information on the size distribution of tropospheric background aerosols, the sensitivity has to be improved by at least a factor of 5 and the range has to be extended down to 10 to the minus seventh power cm radius. Ion mobility measurements are not capable of meeting these requirements for basic and technological reasons. (Author conclusions modified)

5360 APTIC NUMBER 14819

Adams, Martha L.
QUANTITATIVE MIXED SOLVENT ANALYSIS BY INFRARED SPECTROPHOTOMETRY. Army Coating and Chemical Lab., Aberdeen Proving Ground, Md., Proj. 1T062105A329, CCL Rept. 268, 24p., May 1969. 1 ref.
CFSTI, DDC: AD 688588

For many years, thinners and solvents for enamels have consisted of petroleum hydrocarbons. Thinners and solvents for lacquers are usually mixtures of such oxygenated compounds as esters, ketones and alcohols, blended with aromatic hydrocarbons. New restrictions on olefins, certain aromatic hydrocarbons, and some of the ketones will result in entirely new combinations of solvents in both of these classes of coatings. Existing analytical methods are not entirely adequate for exercising suitable quality control. A very useful technique for quantitatively measuring the photochemically reactive aromatic hydrocarbons in enamels and thinners employs gas-liquid chromatography for the solvent separations and is widely used throughout the industry, but it is incapable of separating oxygenated solvents from aromatic hydrocarbons. When the presence of ketones, esters, etc., is indicated in a sample, a chemical separation of the oxygenated materials must precede the analysis for the aromatics. This report describes work that was undertaken to evaluate the potential application of infrared spectrometry to the complete analysis of complex mixtures of the various types of solvents. The plan followed involved formulation of typical solvent mixtures that would meet current restrictions for lacquer and enamel formulations, followed by analysis with calculations made from infrared spectra. The following mixtures were proposed; a combination of mineral spirits, toluene, and n-butanol as a solvent mixture for short oil alkyds to replace xylene; methyl ethyl ketone, hexane, and butyl acetate for vinyls to replace toluene; glycol ether acetate and ethyl amyl ketone for moisture-cured urethanes to replace aromatics; and 2-nitropropane with aliphatics to replace aromatics.

5361 APTIC NUMBER 15330

Agarwal, M. K., D. N. Shivpuri, and K. G. Mukerji
STUDIES ON THE ALLERGENIC FUNGAL SPORES OF THE DELHI, INDIA, METROPOLITAN AREA. BOTANICAL ASPECTS (AEROMYCOLOGY). J. Allergy, 44(4):193-203, Oct. 1969. 32 refs.

The prevalence of fungal spores in the Delhi atmosphere was determined by simultaneous exposure of one slide and three Petri dishes daily, at intervals for one full year. On the slides, the spores of Alternaria sp., Cladosporium sp., small round spores, Curvularia sp., and Helminthosporium sp. were most frequently in that order and formed 83.5% of the total spore count. In the Petri dishes, colonies of Cladosporium sp., Alternaria sp., Aspergillus sp., Curvularia sp., and Fusarium sp., were most common and formed about 85% of the total colony count. There were two peak periods of fungal spore concentration in Delhi: one from September to November and the other from February to April. These aeromycologic findings seem to provide an additional explanation of earlier clinical observations that most patients get their symptoms (or aggravation of symptoms) during these two seasons. There were drawbacks to adopting one method only, either slide exposure or Petri dish exposure, and distinct advantages to using both the techniques simultaneously. (Author abstract modified)

5362 APTIC NUMBER 15607

Akagi, Mitsuru, Minoru Tsukahara, Masakazu Okai, and Hiroshi Kamegaya
STUDIES OF ENGINE EXHAUST GAS ON AIR POLLUTION. III. EFFECT OF FUEL PROPERTIES ON DIESEL ENGINE SMOKE. (Taiki osen busshitsu toshiteno kikan haiki no kenkyu. III. Nenryo no shurui ga dizeru enjin haiki-en ni oyobosu eikyo). Text in Japanese. Tamagawa Daigaku Kogakubu Kiyo (J. Fac. Eng. Tamagawa Univ.), no. 4:15-27, 1969. 7 refs.

The density of smoke from a diesel engine was measured as the concentration of carbon particles in the diesel engine exhaust gas by the use of an oil dispersion photoelectric filter photometer. The diesel engine used in this study had an ejection pressure of 120 kg/sq; a compression ratio of 18:8; one cylinder, pre-combustion room of 95 by 115 mm in size; and a circulating water cooling system. The following factors which influence the

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concentration of carbon particles in the exhaust gas were kept constant: the compression ratio, shape and size of compression room, and ejection pressure; the following factors were variably changed: the fuel-air (concentration) ratio, the degree of the engine work, negative pressure of the air suction from the outside air, temperature of the coolant (circulating water), and the kind of fuel. Fuels used were heavy oil (A); light oil (B); 50% A + 50% B (C); pure lump oil (D); and 50% A + 50% E (D). The concentration of carbon particles in the exhaust gas increased with the increase of the degree of engine work, the negative pressure and the fuel-air (concentration) ratio, and with the decrease of viscosity of the fuel and the temperature of the coolant. A smoke depressant (barium) inhibited both heat decomposition and dehydrogenation of the fuel which create the carbon particles. There was no difference in the shape (globular) and size (200 to 500 A in diameter) of the carbon particles between those produced with the smoke depressant and those produced without using the depressant when the particles were examined by electron microscopy. The authors confirm the efficiency of this oil dispersion photoelectric filter photometer for the study of exhaust gas of diesel engine which operates on various kinds of fuel under the various conditions of combustion.

5363 APTIC NUMBER 15577

Baer, Charles H.
THE RESPONSE OF SENSITIVE PLANT SPECIES TO ATMOSPHERIC POLLUTANTS IN THE KANAWHA VALLEY OF WEST VIRGINIA. (Final Report.) West Virginia Univ., Morgantown, Inst. of Biological Sciences, Contract PH 86-66-96, 12p., March 1967. 3 refs.

An attempt was made to evaluate the biological effects of air pollutants in the Kanawha Valley, West Virginia by using sensitive plant species as indicators of the effects. Plant species known to be sensitive to atmospheric pollutants common in Kanawha Valley were planted in plots distributed from Winfield to Gauley Bridge and observed for injury. The plants were white pine, beech, cotton, alfalfa, gladiolus, and tomato. The meager data obtained gave no conclusive evidence concerning the presence or absence of injurious atmospheric pollutants at any of the 73 sites. Numerous difficulties and delays during the first 3 months of the study, which covered the growing season, resulted in most of the plants being considered unsuitable pollution indicators. The needle tip burn on some of the white pine seedlings resembled the known symptoms caused by low levels of sulfur dioxide fumigation. These symptoms were not as typical on the plants exposed in the Kanawha Valley as were the symptoms on check plants exposed near a known source of sulfur dioxide in the Ohio Valley. White pine seedlings exposed during the same period to clean air were virtually free of tip burn. The other plants exposed in the same locations were so drastically reduced in number and quality by transplanting, drought, pathogens, and other causes that they were considered useless as reliable detectors of air pollution. Methods are proposed for eliminating the difficulties encountered in this initial plant detector study.

5364 APTIC NUMBER 15762

Bardswick, W. A. and P. T. M. White
TRENDS IN THE INSTRUMENTAL ASSESSMENT OF INDUSTRIAL DUSTINESS. Can. Inst. Min. Metall. Bull., Oct. 1969. 23 refs.

The parameters of airborne minerallic particulates which create industrial dustiness, together with the physiological hazards caused by their inhalation are reviewed. The techniques of dust sampling discussed and analysed are filtration, inertial collecting, thermal precipitation, electrostatic precipitation, and light scattering. The parameters are classified as the basis for methods of assessing the physical, chemical, and mineralogical characteristics of dust-particle suspensions. Those methods of assessment currently accepted by various statutory authorities are surveyed. Other methods that warrant attention and newer techniques that are being developed are reviewed. (Author abstract modified)

5365 APTIC NUMBER 15515

FINAL REPORT ON FEASIBILITY STUDY FOR SENSING SULPHIDES IN COAL - 1968. Barringer Research Ltd., Rexdale, Ont., Canada, Contract PH86-67-270, Project 385, TM-68-55, 36p., Feb. 1968. 2 refs.

This report summarizes the work done in a feasibility study of a prototype monitor for sensing sulfide ores in coal, details laboratory experimentation, circuits and techniques, and gives the results of measurements. The principle employed in the monitor is the absorption of power by the conductive sulfide at radio frequencies. Sulfur content of interest was over 0.5-5% band at the normal operating frequency of 500 KHz. When circuit changes were made, signal-to-noise ratios improved, but the signals obtained were still very weak. Frequencies were increased to induce an increased loss into the very small particles of sulfide. It was found that even at 50 MHz with shielded coils, there was still no indication of power absorption into 5% sulfur coal. When frequencies were increased to the microwave region, coils became smaller and the coal samples were pulverized. Finally, with an abbreviated coil and grid dip circuit between 800 and 900 MHz, sharply increasing signals were obtained, which correlated with the sulfur sequence of the samples. For work at higher frequencies, the coil configuration was replaced with waveguide and cavity constructions. The frequency range of 500-1100 MHz was covered to check agreement with the grid dip circuit method. Qualitative agreement was evident and the coaxial cavity method showed acceptable differential signals over near zero to 5% sulfur samples even below 800 MHz. Another method was suggested which led to the construction of a flash heater or volatilizer, in which pulverized samples could be burned by a spectrometer to give a proportional indication of the sulfur content of the sample. Results with this method show very acceptable linearity over the range of interest. It is concluded that worthwhile follow-up work is indicated.

5366 APTIC NUMBER 15368

Baum, Fritz and Frank Dietrich
AUTOMATICALLY INTEGRATING WIND GAUGE FOR AIR POLLUTION

MEASUREMENTS. (Automatisch integrierender Windmesser fuer Luftverunreinigungsmessungen). Text in German. Gesundh. Ingr., 89(8):242-247, 1968. 12 refs.

An automatic gauge is described which averages measurement results in a much shorter time than other anemometers. The new unit operates on a modified Woefle principle. Individual electric pulses are generated and then summed up by a pulse counter. A pulse transmitter, which sends out pulses in 1-sec intervals, is used for determining the frequency distribution of wind direction. The pulses go to 16 relays, one for each wind direction. In addition, there is another relay for counting periods when wind speed is less than 0.3m/sec. Wind speed is measured by the rotary speed of the cup anemometer of the Woefle wind recorder that houses the vane recording wind direction, a DC generator, and a photoelectric revolution indicator. The pulse generator and the relays are housed in a separate unit. Test operations with the new gauge show that it can evaluate a 10-day measurement series in one hour. Moreover, accuracy is obtained with the new unit. Conventional recorders would require one day.

5367 APTIC NUMBER 15549

Baum, Fritz
COMPARATIVE MEASUREMENTS USING DIFFERENT DUST MEASURING METHODS AT VARYING DUST LEVELS. (Vergleichsmessungen mit verschiedenen Staubmessverfahren bei unterschiedlichen Staubpegel). Text in German. Gesundh. Ingr., 87(12):357-366, Dec. 1966. 26 refs.

For comparative measurements, various dust measuring units were set up at a selected measuring station. The quantities of collected dust were determined, and the results obtained with each unit were studied for statistical correlations among the various methods. In the city of Baden-Wuerttemberg, comparative measurements were conducted at six different sites by this procedure. The average dust level varied among measuring stations. If the results obtained with adhesive foils (25 to 88 comparative values) were compared, close correlations were found among almost all stations, although the dust levels varied. If the results obtained with various units set up at the same measuring site were compared (12 comparative values), statistical correlations were found only at a certain dust level. If the dust level (referred to the Bergerhoff unit) was below 3 g/sq m/month, no statistically confirmed correlations could be obtained, since the errors caused by interference were too high. At a dust level of 6 g/sq m/month, a certain correlation was discernible, and at a dust level of 18.6 g/sq m/month, the results were capable of being statistically confirmed, since interference had a negligible effect in this case. The dust level is thus of great importance to the statistical correlations in comparative dust measurements. Dust levels between 10 and 15 g/sq m/month (Bergerhoff) are recommended for such comparative measurements.

5368 APTIC NUMBER 13725

Benarie, M. and D. Rodin
SIMPLE AUTONOMOUS PORTABLE APPARATUS FOR MEASURING THE CONCENTRATION OF THE SOLID AND GASEOUS AGENTS IN THE AIR. (Appareil simple, autonome et portable pour la mesure de la concentration des polluants solides et gazeux dans l'air). Text in French. Poll. Atmos. (Paris), 11(42):80-84, April/June 1969.

A device was conceived in which the catalytic oxidation of methanol creates a rising current in the interior of a small chimney. A mass of air up to a thousand times the mass of the methanol burned is drawn in through an electrofilter or an absorbent column. The idea led to the development of a portable, autonomous apparatus permitting the continuous extraction of atmospheric dusts over a period of 10 to 15 days. The apparatus is easily adapted to the measurement of gases and vapors. (Author summary modified)

5369 APTIC NUMBER 18830

Benes, Milos, Milada Malechova, Jiri Malecha, and Jaroslav Myslivecek
ANALYSIS OF GASEOUS MIXTURES CONTAINING CARBON MONOXIDE, CARBON DIOXIDE, HYDROGEN, METHANE, NITROGEN AND OXYGEN. (Deleni smesi kysliciniku uhelnateho, kysliciniku uhliciteho, vodiku, methanu, dusiku a kysliku plynovou chromatografii). Text in Czech. Chem. listy, 63(6):703-709, 1969. 13 refs.

The title compounds are found in combustion products, in chemical plants, and in all cases where the burning of fuel is not fully accomplished. The use of gas chromatography for measurement gives more precise and rapid results than all other known methods. Analysis of incompletely burned methane uses helium as carrier gas and thermal conductivity and combustion detectors are used for determinations. Gases are separated on a molecular sieve 5A and Synachrome. Individual gaseous mixtures are recorded at maximal sensitivity, in accordance with possible percentage content of individual components in the sample. From empirical results it is evident that the greatest accuracy is achieved for carbon dioxide and methane and the least for nitrogen.

5370 APTIC NUMBER 18052

Bernert, Juergen
PRACTICAL HINTS FOR INSTALLATION AND OPERATION OF STATIONARY MEASUREMENT AND ANALYSIS DEVICES FOR MONITORING OF EMISSIONS. (Praktische Hinweise fuer Aufstellung und Betrieb von stationaeren Mess- und Analysengeraeten zur Emissionsueberwachung). Text in German. Wasser, Luft Betrieb, 13(2):39-41, Feb. 1969. 8 refs.

An explanation is given of the administrative and technical aspects of the German Federal regulation 'Technical Directions for Maintenance of Clean Air' and of a pertinent circular, issued in 1964 and 1968. The stationary measuring devices must be installed by every plant whose emissions of dust and SO2 exceed 25 and 200 kg/hr and must include a dust concentration meter (with oil-fired plants - a smoke density meter), a CO2 concentration meter, a thermometer, a SO2 conconcentration meter, and a continuous recording device for all these items. The plant manager must have

a service agreement with the manufacturer of the device for an annual inspection on its operation. The minimal operating requirements of the individual measuring devices are specified and a fairly extensive glossary of German terms from the field of engineering measurements, together with explanations of some pertinent concepts, are included. Finally, a detailed example is given of determination of the emission concentrations of flue gases referred to standard conditions.

5371 APTIC NUMBER 14498

Blunck, Otto
GENERAL PROGRESS AND PRESENT STATUS OF THE NON-DISPERSIVE INFRARED GAS ANALYSIS TECHNIQUE. (Allgemeine Fortschritte und gegenwaertiger Stand der nicht-dispersiven Ultrarot-Gasanalysentechnik). Text in German. Arch. Tech. Messen, no. 395:263-268, Dec. 1968. 28 refs.

A review of non-dispersive infrared gas analyzers shows that no revolutionary structural changes have been made in these units. They still comprise a radiation source, an analyzing cuvette, a reference cuvette, a radiation detector, and an electronic amplifier. After a review of the physical principles underlying these units, the innovations of the past few years are discussed. The lengths of cuvettes range from 0.2 to 300 mm. Extra-long and high-pressure cuvettes are not used anymore. Two-component glues are used for sealing the window. A unit employing a micro flow probe for measuring the gas flow between analyzing and reference cuvettes has been developed. The probe consists of two nickel screens 0.2 mm apart. Both screens are subject to intense heat coupling which can be changed by the smallest gas flows. The screen touched first by the gas flow is colder than the other. In this way, a sensitivity is achieved which is 10 to 20 times as high as the older method of measuring the cooling of a single heated screen. Infrared light is transmitted through the analyzing and reference cuvettes either in parallel phase or in counter phase. Units with one or two radiation detectors are on the market. Generally infrared gas analyzers are designed for wall mounting, but there is a trend toward compact portable versions.

5372 APTIC NUMBER 14691

Bors, J.
MARKING AND DETECTION OF CONIDIA IN MICROORGANISMS WITH THE INDICATOR-ACTIVATION METHOD. (Markierung und Nachweis von Conidien bei Mikroorganismen nach der Indicator-Aktivierungsmethode). Text in German. Arch. Mikrobiol., vol. 53:181-188, March 8, 1966. 9 refs.

A method for the study of dispersion of microorganism spores was developed. For marking spores, a stable element was used instead of a radioactive indicator. Aspergillus niger was used as the microorganism with manganese, which radiates beta and gamma rays with maximum energies of 2.84 and 2.12 MeV, as indicator. After cultivation of the spores on Mn-nutritive solution, they were activated for about 30 sec with thermal neutrons and the developing beta radiation was measured in counts per min. The spores grown on Mn-nutritive solution had a considerably higher activity than normal spores. In the autoradiographic detection method, the photographic emulsion absorbed the water-soluble Mn from the spores. To prevent this occurrence, a layer of collodiumamylacetate was sprayed over the spores, but some spots remained where the Mn was absorbed. The problem was finally solved by using nuclear trace plates, type G-5 Ilford. The problem of losing spores in the transfer to microscope slides was solved by using araldite of the type AW 106 (H 953 U).

5373 APTIC NUMBER 15706

Bowman, M. R., A. J. Gibson, and M. C. W. Sandford
ATMOSPHERIC SODIUM MEASURED BY A TUNED LASER RADAR. Nature, 221(5179):456-457, Feb. 1, 1969. 19 refs.

In earlier investigations of the upper atmosphere by optical radar, a pulsed ruby laser was used in the transmitter and measurements of the Rayleigh scattering by air molecules gave density profiles. A radar for the detection of specific atoms or molecules can be made by tuning the laser to an appropriate resonance. The application of resonance radiation to the measurement of sodium is discussed. Parameters of the system are presented. Results of measurement of the night time abundance and distribution of atomic sodium are presented.

5374 APTIC NUMBER 15908

Braman, Robert S.
EMISSION-TYPE DISCHARGE STUDY OF SOME AIR POLLUTANT COMPOUNDS. Preprint, American Chemical Society, Washington, D. C., Div. of Water and Waste Chemistry, 16p., 1969. 3 refs. (Presented at the American Chemical Society, 158th National Meeting, Division of Water, Air, Waste Chemistry, New York, Sept. 8-12, 1969.)

The applicability of a four-channel DC discharge system to gas chromatographic analysis of air pollutants was investigated in laboratory analyses of automobile exhaust and other gas mixtures. Air pollutants studied included carbon monoxide, sulfur dioxide, nitrogen oxides, and carbonyl sulfide. Alkanes, alcohols, and other compounds were also investigated for comparison purposes. The four major wavelengths observed were 5165 C2; 4312 CH; 4216 CH; and 6562 H. The detector gave good response patterns suitable for qualitative identification of gases and pollutants and was particularly useful in confirming the identity of air peaks, hydrogen, CO, hydrocarbons, and CO2. Limits of detection air in the ppm range. The limits need improvement if sub-ppm concentrations are to be directly analyzed and detected in air. Data presented in the form of tables include wavelength and band/line spectra of analyzed compounds, response data, and emission ratios for a series of alcohols.

5375 APTIC NUMBER 14683

Brodovicz, Ben A., Jr.
AUTOMATIC, TELEMETRY, COMPUTER...KEY WORDS IN PENNSYLVANIA'S AIR POLLUTION CONTROL PROGRAM. International Business Machines Corp., White Plains, N. Y., Data Processing Division, Proc. IBM Scientific Computing Symp. on Water and Air Resource Management, Yorktown Heights, N. Y., Oct. 23-25, 1967, p. 95-113.

The regulatory plan for control of air basin air pollution in Pennsylvania specifies a central air monitoring station having the flexibility to monitor pollution, provide an air pollution alert service, and conduct short-term sampling for specific pollutants. The central station will be connected to a network of semipermanent stations for detailed air basin monitoring, permanent stations located throughout Pennsylvania for surveillance and long-term evaluations, and single mobile units equipped with their own data acquisition systems for short-term sampling studies. All the remote units will telemeter to a central headquarters in Harrisburg. The central station will contain the necessary hardware to receive and process the data, calculate the results, and permit supervisory control of the entire system. The use of communication links to acquire and log data from remotely located monitoring units at a central station provides the means for a state agency to eliminate the difficulties posed by time, distance, and volume of data. The central station features computer control in combination with output options. The computer system provides parallel input and output, priority interrupt features, and block transmission of data. It contains provisions for immediate display of edited data, command and alarm information, and presentation of routine statistical results, as well as special statistical information of a long-term nature. Transmission of digital information will be accomplished over telephone lines.

5376 APTIC NUMBER 13583

Brunauer, Stephen and Paul H. Emmett
THE USE OF LOW TEMPERATURE VAN DER WAALS ADSORPTION ISOTHERMS IN DETERMINING THE SURFACE AREAS OF VARIOUS ADSORBENTS. J. Am. Chem. Soc., Vol. 59, p. 2682-2689, Dec. 1937. 12 refs.

Low temperature van der Waals adsorption isotherms of various gases have been determined on a variety of adsorbents. Argon and nitrogen were determined at -195.8 C; argon, nitrogen, carbon monoxide and oxygen at -183 C; carbon dioxide at -78 C; and butane and sulfur dioxide at 0 C. A number of different adsorbents were used, including copper catalysts, nickel, silica gel samples, and activated carbon. All the adsorbents except carbon gave S-shaped isotherms. The values for the surface area evaluated from the different isotherms for the same adsorbent were consistent with each other.

5377 APTIC NUMBER 15525

Buchanan, L. M., H. M. Decker, D. P. Frisque, C. R. Phillips, and C. M. Dahlgren
NOVEL MULTI-SLIT LARGE-VOLUME AIR SAMPLER. Appl. Microbiol., 16(8):1120-1123, Aug. 1968. 2 refs.
AD 686356

A multi-slit impinger was developed which will recover a high percentage of viable microorganisms from the atmosphere. It operates on the principle of inertial impingement of airborne particles into a liquid film maintained on the surface of a rotating disc. Air is drawn into the sampler through small rectangular slits located near the surface of the liquid film. The collection liquid is pumped to the center of the disc through a stainless steel tube that is suspended above and across the diameter of the disc. This tube also serves as a spreader to distribute the liquid uniformly over the surface of the disc. High-velocity air jets directed against the film cause the airborne particles to impinge into the liquid. The particle-laden liquid then flows across the surface of the disc and is removed by a hollow plastic scraper that touches the rim of the disc and allows the liquid to pass into a collection tube from which it is removed by vacuum into the effluent container. The impinger was evaluated and found to have an average collection efficiency of 82% for S. marcescens and 78% for B. subtilis var. niger spores. It has potential application in studies related to airborne transmission of disease, and in the continuous monitoring of air to detect viable airborne microorganisms. The valuable features include an air-sampling rate of 500 l/min, a high collection efficiency, and a low pressure drop; it does not depend upon electrostatic precipitation at high voltages.

5378 APTIC NUMBER 14729

Bulba, E.
SCANNING ELECTRON MICROSCOPY. Dust Topics, 6(1):4-9, Feb. 1969. 13 refs.

With the scanning electron microscope, the object to be photographed is scanned by an extremely fine electron probe which produces a sequential image on the screen of the display cathode tube. If the scanning rate is fast enough, the observer will see a complete image of the object. Images obtained by scanning electron microscopy resemble those formed by reflected optical light microscopy, but with much greater depth of focus and at much higher magnifications. Extremely fine details can be detected as a consequence of the curved trajectories of the electrons emerging from the scanned object, which allow for visualization of points not in the direct line of sight of the electron collector, such as areas behind protruding surfaces, depressions and re-entering holes. A spatial impression of imaging is obtained which is suitable for stereophotographs. Specimens are not affected by either the electron beam irradiation or the vacuum. Scanning is feasible on dust samples without previous resin fixation, and quantitative determination of the dust mineralogical composition can be established by the response of individual particles to the electron beam, because more electrons are reflected by high than by low atomic number elements. Direct exploration of surfaces with high quality of image and resolutions in the fields of biology, geology, ceramics, textiles, metallurgy, microcircuitry, plastics, and air pollutants is now feasible. In addition, most of the physical and chemical characteristics that depend on the interaction between substances and electrons can be observed as images. Scanning electron microscopy offers techniques which are complementary and supplementary to optical light microscopy and conventional transmission electron microscopy.

5379 APTIC NUMBER 13789

Burnett, William F.
AIR POLLUTION FROM ANIMAL WASTES: DETERMINATION OF MALODORS BY GAS CHROMATOGRAPHIC AND ORGANOLEPTIC TECHNIQUES. Environ. Sci. Technol., 3(8):748-749, Aug. 1969. 21 refs.

A combination of gas chromatographic and organoleptic techniques was used to determine the chemical compounds responsible for the offensive odor of accumulated liquid poultry manure. The volatile odorous substances were trapped and concentrated in short sections of gas chromatographic columns held at -78 C, separated by gas chromatography and identified by the correspondence between relative retention time and the odors of the peaks for the unknowns and authentic compounds. Mercaptans, sulfides, and diketones were identified. Volatile organic acids and the nitrogen heterocycles, indole and skatole, were also identified, using direct injections of liquid manure supernatant and standard gas chromatographic techniques. The sulfur compounds, organic acids, and skatole were implicated as important malodorous components involved in air pollution. Prevention of the odor causing substances, rather than the use of masking chemicals, was suggested as the best means of control. (Author abstract modified)

5380 APTIC NUMBER 15763

Candeli, A. and G. Morozzi
THE PROBLEM OF THE CARCINOGENICITY OF ATMOSPHERIC POLLUTANTS. III. THE RADIOACTIVE TRACER TECHNIQUE FOR THE QUANTITATIVE DETERMINATION OF AROMATIC POLYCYCLIC HYDROCARBONS. (Il problema della cancerogenicita dell'aria inquinata: III. Tecnica dei traccianti radioattivi per la determinazione quantitativa degli idrocarburi aromatici policiclici). Text in Italian. Giorn. Igiene Med. Prevent. (Genoa), 10(1):3-15, 1969. 20 refs.

A tracer technique using H 3- labeled 3,4-benzopyrene was employed to determine the extent of 3,4-benzopyrene loss during analytical procedures such as column chromatography followed by paper chromatography. The H 3-labeled benzopyrene was added to a solution of pure aromatic polynuclear hydrocarbons as an internal standard. The amount of H 3-labeled benzopyrene was determined at the beginning and end of the analysis by a liquid scintillation couting technique. The experimental results showed that the recovery percentage of tritiated 3,4-benzopyrene corresponds to the recovery percentage of the non-tritiated 3,4-benzopyrene. The tracer technique was also satisfactory with other polynuclear compounds. The loss of the polynuclear compounds was about 30% after column chromatography and 50% after paper chromatography. The analysis of the particulate matter of gasoline engine exhaust gases showed a loss of the tritiated compound which was similar to that revealed on mixtures of pure aromatic polynuclear compounds. (Author summary modified)

5381 APTIC NUMBER 18450

Chapoux, P.
THE POLLUTION OF AIR BY AUTOMOBILE PUMPS. (La pollution de l'air par les fumees d'automobiles). Text in French. Pollut. Atmos. (Paris), no. 39:156-170, July-Sept. 1968.

The total emission of carbon monoxide by automobiles per distance has been found by the Union Technique de l'Automobile, du Motorcycle, et du Cycle (U.T.A.C.) to be erratic and mostly dependent on the fuel system. Provided that ignition occurs, delay does not affect the amount of emission. High pollutant emission occurs near idling and at maximum power, but in the latter case, the volume emitted is much greater. In 1960-1961, a series of tests were conducted on congested roads in Paris. Motor speed, fuel delivery-pipe pressure, gear change, use of brakes, and acceleration were recorded. The results were not reproducible, but they suggested that the engine is never used at maximum power at the greatest rotation rate, and is only fully charged at low speeds. The speeds did not exceed 60 km/hr., idling time was about one-third, and fuel consumption was 2-3 times that on a test circuit. A standard run was set up on a track with numerous stops to reproduce urban conditions. Comparative tests of carbon monoxide emissions were also made. For general use, a static motor test is needed. This requires a standard cycle of speeds and accelerations representing the average traffic flows and a measurement of total pollution. The U. S. cycle was unsuitable because top speeds and accelerations were higher than in European towns. A cycle was designed by the U.T.A.C. for use with the California measuring apparatus. It has 5% more accelerating time and 3% more idling time. A pollution problems group has produced a European testing cycle. Legal limits for automotive emissions are not yet established in Europe. Elimination of fuel loss to the atmosphere using blowby and opacimetric control of diesel fumes are under consideration.

5382 APTIC NUMBER 15899

Coenen, Wilfried
A SIMPLE FLOW-SENSITIVE DEVICE WITH A HOT CONDUCTOR WIRE AND ITS ENGINEERING APPLICATIONS FOR DUST MEASUREMENTS. (Eine einfache, stroemungsempfindliche Anordnung mit Heissleiter und ihre technischen Anwendungsmoeglichkeiten bei der Staubmessung). Text in German. Staub, Reinhaltung Luft, 29(11):455-459, Nov. 1969. 7 refs.

The problem of sample volume determination for dust measuring instruments was discussed. It was shown that a constant air flow is required in special cases of dust measurement. An arrangement, sensitive to flow and equipped with a hot conductor is described which, as a result of its small dimensions and simple design, is particularly suitable. The electric circuit of this arrangement was given. Factors influencing the flow-sensitive signal were discussed on the basis of measurement data. Technical applications of this arrangement were illustrated with examples. (Author summary modified)

5383 APTIC NUMBER 15242

Trider, Walter T.
AN AUTOMATIC FLAME EMISSION INSTRUMENT FOR SELECTIVELY MONITORING SO2 IN ANIMAL EXPOSURE CHAMBERS. Analysis Instrumentation, vol. 4:67-73, 1967. 4 refs.

An automatic instrument employing the principle of flame emission photometry was constructed to selectively monitor SO2 in animal chambers containing photochemically reacted auto exhaust. The instrument was calibrated from 0.1 to 1.5 ppm SO2. Construction details and operating characteristics are discussed. Because this instrument is designed to measure SO2 concentrations by an alternating sample-purge cycle, both the rate of response and the maximum response during the 30-sec exposure cycle are important. The precision with which SO2 concentrations can be determined with this instrument is within approximately two and a half percent over the range of 0.1 to 1.5 ppm. Instrument accuracy is within 5% as determined by the modified West and Gaeke colorimetric technique. Because of the detection principle employed, any airborne sulfur compounds in concentrations near those of the SO2 being monitored are expected to cause false responses. However, no interference was observed in animal exposure chambers containing photochemically reacted auto exhaust and animal respiratory and excretion products.

5384 APTIC NUMBER 15566

PASSIVE IR SO2 SENSOR. (FINAL REPORT.). Dalmo Victor Co., Belmont, Calif., Contract PH 86-66-155, R-3235-8589, 50p., Oct. 1967.
CFSTI: PB 187390

A remote operating four channel passive infrared radiometer was developed for measuring SO2 8.7 micron radiation in plumes from fossil-fuel thermal plants, particularly coal-fired electric power plants. The radiometer opens a new field of remote quantitative analysis, performing quantitative measurements by refering the signal strength of SO2 to a known signal strength, CO2, and by subtracting proper portions of the interfering and background signals. The instrument is portable and needs only to be brought within a range of 100 to 1000 meters. The ratio of SO2 to CO2 is read directly off the instrument panel. No further calculations are necessary to obtain meaningful air pollution potential measurements. While there are limits to the environment compensation and rejection, the sensor is more accurate than other existing instruments and techniques. It has an orthogonalized ratio computer which computes the ratio of SO2 radiation at 8.7 microns to the CO2 radiation at 9.4 microns. The spectral overlap for each of four signals is stored in the sensor's computer. The mixed signals (four component vectors) from the four signal channels are separated (orthogonalized) by summing appropriate amounts of each channel (vector coordinate transformation). Two of the separated signals (perpendicular vectors) go to a phase detector which generates a function of the two components as the arctangent (the vector sum angle) of the component ratio. The ratio function is separated from the arctangent function by the non-linear scale of the panel meter. (Author abstract modified)

5385 APTIC NUMBER 14834

Danilov, A. I. and Yu. P. Pokhitonov
EQUIPMENT FOR DETERMINING THE SIZE OF AEROSOL PARTICLES IN LIQUID DISPERSION. Med. Prom. SSSR, no. 9:41-44, Sept. 1966. 8 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 6p., March 1, 1968.
CFSTI, DDC: AD 682771

Microscope attachments for use in sampling liquid aerosols and their photoregistration are described. They facilitate calibration of atomizers and investigation of the dispersion condition of an aerosol cloud in a chamber. A diagram presents the basic setup, and variations for other uses are suggested. At the moment of intake of the aerosol sample an object plate moves out to put a base between the funnels through which the air is drawn. For inspection, the base lines up with the windows of the controlling plates and the investigation is done visually or by photography. The entire procedure takes about 1-3 minutes. Standard reproducible results were obtained with the flow ultramicroscope when checking for dispersion.

5386 APTIC NUMBER 15660

Das, H. A.
APPLICATION OF ACTIVATION ANALYSIS TO THE PROBLEM OF AIR POLLUTION. (Toepassing van de activeringsanalyse op het probleem van de luchtverontreiniging). Text in Dutch. Chem. Week., 65(30):7-8, July 25, 1969. 3 refs.

Whatman 1, 41, 42, and 541 filters, Millipore AA and WS HTTP Teflon filters, and activated and unactivated C paper were tested and compared for their particle collecting efficiencies. Also investigated was the possible interference by natural filter elements: Cl, Mn, Na, Al, Br, and V. Highest interference was found for Cl and Na. The Teflon filter was considered the most suitable. The filters were tested for interfering elements in Lerwick (Shetland), Milford Haven (Pembroke), Chilton (Berkshire), and Salford (Lancashire). The analytical conditions were as follows: 5 min irradiation; thermal neutron flux of 1.2 times 10 to the 12th power sq cm/sec ; and a 3 min count with a 3 by 3 in NaI crystal on a 512 channel analyzer.

5387 APTIC NUMBER 15255

Debrun, G.
THE 'S. F.' (SULFUR - SMOKE) CONTINUOUSLY RECORDING APPARATUS. (Appareil 'S. F.' (soufre - fumees) enregistreur en continu). Text in French. Pollut. Atmos. (Paris), no. 38:81-87, April-June 1968.

Legislation in France requires certain installations to use low-sulfur fuels when the sulfur content of the air reaches 1 mg/cu m. Thus, an apparatus for continuous monitoring of the sulfur dioxide content of the air is required. In the 'S. F.' apparatus, air is drawn in at the constant rate of 100 l/hr

through a filter (which can be changed daily for measurement of blackening pollutants) and then through a bubbler containing hydrogen peroxide solution and a pH measuring electrode. Additions of N/640 alkali solutions are made automatically under control of the pH meter to maintain a pH of 4.5. This choice of pH avoids interference by atmospheric CO2. The position of the piston of the pump adding the alkali is recorded on a moving chart, and the piston is drawn out at regular intervals, thus resetting the recorder and drawing alkaline solution into the pump barrel. The trace on the chart gives the amount of alkali injected in the standard time interval and thus measures the acidity of the air. If water is added automatically to maintain the level in the bubbler against evaporation, the solutions need only be changed every two weeks. Comparison with a standard SO2 measuring apparatus showed agreement to better than 5%. The cost of the apparatus is about $2000 (1968).

5388 APTIC NUMBER 14796

Desbaumes, P. and D. Mamaciotti
CHEMICAL STUDY OF THE EFFECT ON VEGETATION OF A GASEOUS INDUSTRIAL EFFLUENT CONTAINING HEXAVALENT CHROMIUM. (Etude chimique de l'action sur la vegetation d'un effluent gazeux industriel contenant du chrome hexavalent). Text in French. Pollut. Atmos. (Paris), 10(40):224-226, Oct.-Dec. 1968. 2 refs.

Burning and necrosis of vegetables, fruit, and ornamental trees were noted in a commercial garden near Geneva. Except for the leafy vegetables, the other plants regained their vigor later in the growing season. Analysis of the plants showed a high content of chromium emitted from a chrome plating factory in the neighborhood with a low chimney. The level of chromium varied widely, from less than 1 to 9.8 micrograms/g of plant tissue. The surface of the garden had a content of 8.4-30 micrograms/g of soil, while at a depth of 30 cm, the soil contained 30-71 micrograms/g. This was compared to soil from a garden in Valais which had a chromium content of 1.1-1.9 micrograms/g. The colorimetric method for the determination of chromium in plants was given in detail, since such studies have not been made before. The method chosen is simple, reproducible, and can be applied to very different specimens (leaves, fruit, soil). The sample is dried at 100 deg to a constant weight and 1 g is calcined in a platinum crucible at 600 deg. The residue is dissolved in concentrated sulfuric acid. Permanganate is added and the colored solution is warmed on a water bath for 30 min. Excess permanganate is reduced by addition of sodium nitride, and the solution is refrigerated. A certain amount of diphenylcarbazide solution is then added, and a reading is taken on a photocolorimeter at 540 millimicrons.

5389 APTIC NUMBER 14662

Dikun, P. P.
DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN POLLUTED ATMOSPHERE AND OF OTHER POLLUTANTS BY MEANS OF QUASILINEAR FLUORESCENCE SPECTRA. (Obnaruzheniye politsiklicheskikh aromaticheskikh uglevodorodov v zagryaznennykh atmosfernogo vozdukha i drugikh ob'yektakh s pomosch'yu kvazilineychatykh spektrov fluorestsentsii). Text in Russian. Zh. Prkl. Spektrii, 6(2):202-209, Feb. 1967. 19 refs.

Contaminants present in urban atmospheres were investigated by column and thin-layer chromatography and by spectral analysis of quasilinear fluorescence spectra. Nine substances, including three compounds possessing very high carcinogenic activity, were detected in contaminated atmospheres. Polycyclic aromatic hydrocarbon data obtained from the present investigation were compared with earlier data. Structural formulae of the compounds found in the polluted atmosphere are given. Tables give numerical information extrapolated from data obtained by means of fluorescence spectroscopy.

5390 APTIC NUMBER 14395

Dobbins, R. A. and L. D. Strand
A COMPARISON OF TWO METHODS OF MEASURING PARTICLE SIZE OF Al2O3 PRODUCED BY A SMALL ROCKET MOTOR. California Inst. Technol., Pasadena, Jet Propulsion Lab., Contract NAS-7-100, NASA CR-101353, JPL TR-32-1383, 27p., June 1, 1969. 14 refs.

A study of the particle size of the aluminum oxide produced by a small rocket motor as determined by tank collection and by spectrophotometric tests was performed to rationalize a previous discrepancy and to learn to use these methods in a mutually complementary fashion. Tank collection tests were performed with tank volume, aluminum loading in the propellant, and chamber pressure as the principal variables. The particle size data from tank collection tests was analyzed in the form of various mean diameters, moment ratios, and the mass median diameter. Spectrophotometric tests were performed at three wavelengths on motors with chamber pressure and aluminum content as principal variables. The tank collection tests gave internally consistent results only when the mean size was defined in terms of the low moments of the distribution function. Tank collection results indicated that particle size is independent of tank capacity and aluminum concentration and weakly dependent on chamber pressure. Spectrophotometric tests were in agreement with these observations. It was concluded that the low-moment ratios of the Al2O3 particles show no evidence of growth by velocity slip and collision during their passage through the rocket nozzle. Evidence was presented that indicates that the Al2O3 deposited on the rocket nozzle entrance and lateral surfaces is shed by aerodynamic erosion. No evidence was found to indicate that the particle size of Al2O3 at the nozzle entrance could be controlled. It appeared that particle size at that point is influenced primarily by the gas phase and/or surface reactions that produce Al2O3 from the metallic species and possible agglomeration mechanisms that operate in the region between the propellant surface and the nozzle entrance.

5391 APTIC NUMBER 15156

Doerre, W. H. and A. Knauer
IMMISSION CONTROL THROUGH CONTINUOUS MEASUREMENT OF SUSPENDED DUST AND SULFUR DIOXIDE CONCENTRATIONS WITH RECORDING UNITS.

(Emissionskontrolle durch kontinuierliche Messung der Schwebstaub- und Schwefeldioxidkonzentration mit Registriergeraeten). Text in German. Z. Ges. Hyg. (Berlin), 15(7):505-510, July 1969.

First experiences with two units used for continuous measurement of suspended dust and sulfur dioxide concentrations are discussed. The dust monitor FH 62 A and the Ultragas U3S were used. The former unit operates on the principle of drawing air samples (about 1 cu m/hr) through a filter band where the dust is precipitated. The filter band moves continuously. The dust precipitated during the measuring period is measured by determining the extinction of transmitted beta rays. The second unit operates on the principle of measuring the electric conductivity. The dust monitor was set for a measuring period of 3 hours (short-term concentrations). The long-term concentrations were measured over a period of 24 hours. Long-term dust and SO2 concentrations, as well as the daily average air temperatures and the horizontal wind speed for April 1968, are compared in a graph. The long-term concentrations of the two pollutants show the same variations. Another graph shows the short-term concentrations of the two pollutants. A periodical variation is clearly discernible. The maximum and minimum concentrations occur at the same time. The relationship between the two pollutants is statistically verified by a correlation coefficient of 0.83. The origin of the atmospheric pollutants is found by combining the measured short-term concentrations with the wind direction and by plotting these into a wind rose.

5392 APTIC NUMBER 14589

Dorman, W. G.
DUST SAMPLING. Filtration Separation (Purley), 5(6):549-558, Nov.-Dec. 1968. 10 refs.

The theory of dust sampling and some of the instruments employed in sampling are reviewed. Particles of interest range from submicron to millimeter diameters, and the physical characteristics and behavior of particles in this range are so different that no one sampling device or estimation technique is sufficient. Equations for particle terminal velocity, stop distance, shape factors, motion under centrifugal force, motion in passing through a bed of fibers, and thermal forces are stated and explained. Although not normally suitable for large scale plant problems, the use of sedimentation cells, impactors, impingers, thermal precipitators, gravimetric sampling, cyclones, and electrostatic precipitators as sampling instruments in the workroom or laboratory is feasible. Large scale plants require a combination of these sampling instruments to adequately measure dust emissions, and multi-point sampling is necessary. The possibility of using optical measurements by light scattering and attenuation is being studied.

5393 APTIC NUMBER 15238

Duardo, J. A.
STUDY TO DEVELOP A TECHNIQUE FOR MEASUREMENT OF N-SW ALTITUDE OZONE PARAMETERS. Electro-Optical Systems, Inc., Pasadena, Calif., Contract NAS12-137, EOS Rept. 7087, 217p., Nov. 12, 1968. 190 refs.
CFSTI: N69-19889

Results are presented of a two year study and research effort to evaluate optical techniques for the continuous monitoring of worldwide atmospheric ozone distributions. Laser techniques for remote probing of the atmosphere for ozone are analyzed, and recommendations are made for further study of one specific technique involving ground-based lasers. The report emphasizes the practicality of a passive technique for monitoring ozone from satellites, which relies on the use of the sun as a light source for absorption measurements through the earth's atmosphere. Because of the high sensitivity of the photoelectric detectors used and the high irradiance values of the sunlight in the middle atmosphere, signal-to-noise ratios between 1000 and 10,000 could be achieved by this detector system while maintaining the requisite high spatial and spectral resolutions. The vehicle chosen for the proposed measurement system is the Nimbus meteorological satellite, whose near polar, sun-synchronous orbits would allow excellent coverage of the ozone distributions at high latitudes in both hemispheres. The importance of this type of coverage, from the viewpoint of understanding complex polar atmospheric circulation patterns, is also treated in detail. (Author abstract modified)

5394 APTIC NUMBER 14733

Elshout, A. J. and H. van Duuren
SO2 CONCENTRATIONS IN THE VICINITY OF POWER PLANTS. (SO2-Konzentrationen in der Umgebung von Kraftwerken). Text in German. Mitt. Ver. Grosskesselbesitzer, no. 107:119-126, April 1967. 19 refs.

The atmospheric SO2 concentration was measured at certain points in the vicinity of two Dutch tower plants (Harculo and Nijmegen). The T.C.M. method as described in the Ver. Deut. Ingr. guideline 2451 was used for the measurements. About 2000 individual measurements were taken. At the same time, cumulative sulfate measurements were taken according to the Liesegang method. The two power plants differed in their capacities as well as by their location in residential areas of different population concentrations. The maximum atmospheric SO2 concentrations were found in no instance to exceed the maximum allowable concentration of 0.75 mg SO2/cu m. The emission concentrations measured over longer periods of time were lower than the background concentrations. The maximum atmospheric SO2 concentrations computed according to the improved dispersion formula by Bresser and Hansch agreed with the actual measurements within a factor of 2. The SO2 concentrations computed with the Pasquill formula also agreed well with the measured values. Computation with the nomograms from the Technical Directives for Clean Air Maintenance taken from the Ver. Deut. Ingr. guideline 2289 yielded six times higher atmospheric SO2 concentrations than those actually measured. The measured distance of the maximum atmospheric SO2 concentrations from the emission source were on the average much smaller than the computed ones. The measurements showed that in the mathematical formulas, the horizontal and vertical

diffusion coefficients are too low to render a true picture of dispersion conditions.

5395 APTIC NUMBER 14827

Reich, Karl H.
SAMPLE ADMISSION SYSTEM FOR A FLAME IONIZATION CONTAMINANT DETECTOR. (National Distillers & Chemical Corp., New York) U. S. Pat. 3,460,908. 3p., Aug. 12, 1969. 2 refs. (Appl. July 25, 1966, 5 claims).

A sample admission system for a gaseous organic contaminant flame ionization detector permits sample gas to be mixed with flame fuel gas prior to burning and thus increases the sensitivity of the detector cell by a factor of ten. Premixing is accomplished by providing a connecting conduit between the probe and the hydrogen inlet line. For specific control of the amount of sample gas passed to the gas-fueled flame, the conduit is equipped with a needle valve, orifice, or similar mechanism. The invention is particularly applicable to detectors for organic contaminants in open and reusable food containers.

5396 APTIC NUMBER 13893

Rakowski, Robert P.
EVALUATION OF THE USE OF COMMERCIALLY AVAILABLE DETECTORS FOR HYDRAZINE AND NITROGEN DIOXIDE AS COLORIMETRIC DOSIMETERS. Aerospace Medical Research, Wright-Patterson AFB, Ohio, Medical Div., Proj. 6302, Task 630203, AMRL-TR-68-163, 5p., Feb. 1969. 4 refs.

The color response of several commercially available detector papers for hydrazine and nitrogen dioxide was determined in order to evaluate their usefulness as personal dosimeters. The Rug-it H25b Hydrazine Detector gave satisfactory results in the concentration-time (CT) range of toxicological interest. Appropriate color standards should be prepared and a reusable holder for the detector strips manufactured. The Rug-it H30A Nitrogen Dioxide Detector was satisfactory as a detector for low concentrations of nitrogen dioxide, but did not give colors which darkened enough to permit a quantitative estimate of the CT product to which the strips were exposed. Selpar Nitrogen Dioxide Detector tapes were also satisfactory as a detector for low concentrations of nitrogen dioxide, but since the color developed did not darken at all with increasing time, it was not possible to estimate the CT product of an exposure with this detector. Tables show the response of the three detector papers. (Author's abstract modified)

5397 APTIC NUMBER 14938

Everhard, Frederic H. and Robert P. Hartwell
GAS SAMPLER. (Radio Corp. of America) U. S. Pat. 3,461,727. 5p., Aug. 19, 1969. 7 refs. (Appl. May 29, 1967, 4 claims).

The invention relates to an apparatus for obtaining a representative sample of engine exhaust gases. A source of fluid which is to be collected for analysis of pollutants is connected to a tube. The fluid flows through one or the other of two alternate shunt branches or paths and back to the tube. Resistance to flow in the two paths is made substantially equal by a valve control device. A fluid collector is arranged in one path. The valve is programmed to operate so that the fluid collected is a representative sample of the integrated composition of the gas during the time that the fluid is produced. For example, the amount of gas collected when an engine is accelerating will be proportional to the amount of exhaust gases produced when the engine is accelerating. The fluid collector can be disconnected from the sampling apparatus and taken to a laboratory for gas analysis.

5398 APTIC NUMBER 14434

First, Melvin W.
SAMPLING AND MEASUREMENTS. Environ. Res., 2(2):88-92, Feb. 1969. 1 ref.

Quantitative correlations of disease incidence with the presence in the air of elevated quantities of toxic substances requires careful evaluation of the spatial and temporal distribution of an increasingly large number of interacting chemicals. Although significant relationships between mortality from certain causes and very greatly elevated, but brief, concentrations of sulfur dioxide and particulate matter have been documented for London and New York City, demonstration of detrimental health effects from long continued exposure to lower concentrations of air pollutants has proved difficult. Partly, this may reflect inadequate aerometric data in the past, but it now seems to result principally from an inability on the part of epidemiologists to use effectively the mass of aerometric data that are now being generated. Sampling devices, location of sampling stations, and sampling duration and frequency are discussed. Proper utilization of these elements will provide meaningful data for use in mathematical or simulation models that would make it possible to compare results with other areas. (Author abstract modified)

5399 APTIC NUMBER 15699

Plateau, Jan
APPLICATION OF RADIOISOTOPES FOR CONTINUOUS MEASUREMENT OF DUST CONCENTRATION IN AIR. (Wykorzystanie izotopow promieniotworczych dla ciaglego pomiaru stezenia zapylenia powietrza). Text in Polish. Ochrona Pracy (Warsaw), 24(7-8):41-42, July-August 1969.

The principle of operation of devices for continuous measurement of dust concentration in air based on the absorption of beta radiation by dust collected on a filter tape is described in general terms. A proposal for building such devices, based on studies made at the Central Institute for the Protection of Labor, is presented. Suggested as radiation sources are Pm-147 or C-14. With a 10-20 mCurie source, accumulated dust in the amount of about 1 mg/sq m will give a reduction in detector ionization on the order of 10 to the minus 10 power or more.

5800 APTIC NUMBER 15701

Fortak, H.
COMPARISON OF COMPUTED AND MEASURED MAXIMUM AIR POLLUTIONS AND THEIR DISTANCE FROM THE SOURCE IN THE CASE OF LARGE EMITTANTS. (Vergleich von berechneten und gemessenen maximalen Bodenimmissionen und deren Entfernungen von der Quelle fuer den Fall von Grossemittenten.) Translated from German. Free Univ. of Berlin, Inst. for Theoretical Meteorology, 21p., 1968. 7 refs.

A simplified version of the theory of atmospheric diffusion is applied to simulate maximum ground-level SO2 concentrations measured near large power plants. The results depend strongly on the special form of the plume rise formula. Neither Csanady's original formula nor the new optimized version of it give satisfactory results. A slight modification of the exponent in the optimized Csanady-formula however seems to simulate the measurements in the best way. The simplest way to determine the minimum stack height of large power plants is to limit the calculation to the adiabatic lapse rate and obtain the stack height from a given equation.

5801 APTIC NUMBER 18837

Forwerg, Walter and Hans-Joachim Crecelius
DETERMINATION OF NITROUS OXIDE IN ATMOSPHERIC AIR. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(12):16-19, Dec. 1968. 5 refs.

The determination of nitrous oxide content in air was investigated. Determination is facilitated when two separate gas flows are studied, into one of which an oxidation agent is introduced to effect oxidation of NO to NO2. The difference between the two resulting NO2-concentrations gives the NO-concentration. The degree of oxidation is 97% in a concentration range between 0.2 and 0.5 ppm NO. The moisture content of the test gas was reduced by phosphoric acid, so that an oxidizing mass stability of several weeks was reached. Since the degree of oxidation depends on oxidant layer thickness and on rate of flow, the retention time was measured in order to determine the optimum layer thickness and flow rate. The maximum allowable retention time in the oxidant was 0.8-1.0 seconds. No linear dependence in the range from 5-50 l/hr could be established. The temperature range for favorable oxidation lies between 0-30 C. In the range between 0.2-0.5 ppm NO in air, no dependence of the degree of oxidation on concentration could be established. For a steady concentration of 0.1 ppm NO2 and about 0.1 ppm SO2, no change in the degree of oxidation could be detected in industrial air contaminated with organic substances, ammonia and dust after 4 weeks and a throughput of 50 cu m of air. The standard deviation of the determination is about 5.5% rel., for 1 mg NO/cu m; the determination limit is 0.8 micrograms NO.

5802 APTIC NUMBER 18808

Francis, W. F.
THE MEASUREMENT OF THE DEWPOINT AND H2SO4 VAPOR CONTENT OF COMBUSTION PRODUCTS. Gas Research Board, Beckenham, England, Publication GRB 64, 1952, 17p., 31 refs.

A knowledge of the dewpoint of combustion products of town gas gives an indication of the temperature range over which condensation of an acid film, and hence corrosion, may take place. The variation of the dewpoint of combustion products with H2SO4 vapor content is discussed with the aid of the liquid-vapor equilibrium diagram for the system H2SO4-H2O. It is shown that the presence of a few ppm of H2SO4 vapor raises the dewpoint considerably over that which would be obtained with water vapor alone, and that the effect of the other constituents of town gas products on the dewpoint is negligible. A description is given of the development of apparatus and technique for the measurement of dewpoints by the electrical conductivity method, based on the increase in electrical conductivity of a glass surface which occurs on deposition of a liquid film of an electrolyte such as aqueous sulfuric acid. Using this technique, the variation of dewpoint with H2SO4 vapor concentration was redetermined. The dewpoints observed in the present work are higher than those of Taylor for a given H2SO4 vapor concentration. Condensation of combustion products at temperatures around the dewpoint indicated by the electrical conductivity method has shown that the highest temperature at which an increase in electrical conductivity is observed does coincide with the dewpoint. The application of the electrical conductivity method to the determination of dewpoints of combustion products of town gas is described. An attempt was made to estimate H2SO4 vapor concentrations by absorption of the vapor in an aqueous solution, and to infer the dewpoint from the dewpoint-H2SO4 vapor concentration curve. This was not successful owing to the difficulty of trapping the sulfuric acid mist which was formed. (Author summary modified)

5803 APTIC NUMBER 15700

Frankiewicz, Stanislaw
MEASUREMENT OF DUST CONTENT IN AIR. (Pomiar stezenia zapylenia powietrza). Text in Polish. Ochrona Pracy (Warsaw), 23(5):14-16, May 1969.

A report is made of available information regarding the state of the art with regard to methods for determining dust concentration in production areas, and measurement equipment actually available is discussed. Special attention is given to a description of the dust measuring device type PP which was developed by the CIOP (Central Institute for the Protection of Labor) (Polish (?) Patent No. 48713) and which is now in production. Photos of the device are shown and its operation explained. The device employs a membrane filter with a diameter of 27 mm and samples air at a rate of 0.5 cu m/hr. It measures 110 by 130 by 380 mm and weighs 4.1 kg. No other technical data are given.

5804 APTIC NUMBER 18839

Freedman, P. W., H. W. Lang, and M. Jacobson
GAS CHROMATOGRAPHIC ANALYSES OF THE PRINCIPAL CONSTITUENTS

OF MINE ATMOSPHERES. Bureau of Mines, Washington, D. C., RI 7180, 13p., Sept. 1968. 7 refs.
CFSTI: PB 183 373

A gas chromatographic method for the rapid and accurate determination of oxygen, nitrogen, carbon dioxide, and if present, carbon monoxide, in mine air was developed. This method replaces presently used gas-reaction types such as the Haldane or Orsat analysis, offering advantages of precision, accuracy, speed, and convenience. The gas chromatographic system can detect O2, N2, CH4, and CO2 in a sample of air in concentrations ranging from 0.01 to 100%. Precision and accuracy are attainable over most of the range with a coefficient of variation of plus or minus 1%. Chromatographic analysis is complete within about 7 minutes of sample injection. If carbon monoxide is present in excess of 0.01%, it can be determined as a peak separating about 3 minutes later. The sample is introduced by a gas sampling valve and is split into two analytical columns. Column 1 separates oxygen, nitrogen, and methane, and, if indicated, carbon monoxide. The methane peak appears in about 6 minutes, and the carbon monoxide peak appears in about 10 minutes. Column 2 effects the separation of carbon dioxide from composite gases in about 2 minutes. Concentrations of the gases are quantitatively determined by comparing the integrated peak areas with the areas of standard gas peaks under similar conditions.

5805 APTIC NUMBER 15898

Friedrichs, Karl-Heinz and Arthur Brockhaus
MEASUREMENTS OF PARTICULATE AIR POLLUTANTS WITH TWO FILTER APPARATUS OF DIFFERENT UPPER SEPARATION LIMITS. (Messung partikelformiger Luftverunreinigungen mitzwei Filtergeraeten unterschiedlicher oberer Abscheidegrenze). Text in German. Staub, Reinhaltung Luft, 29(11):467-470, Nov. 1969. 3 refs.

Filters for the preliminary separation of coarse particles by the forces of gravity and inertia were used in the atmosphere. The separation of the aerosol into two portions permitted aerosol size to be compared at different measuring points. Chemical analysis showed a considerable difference between the composition of the fine and coarse particles. Hydrocarbons and 3,4-benzopyrene were found in the fine aerosol. (Author summary modified)

5806 APTIC NUMBER 15376

Gabay, J. J. and N. I. Sax
A SIMPLIFIED TECHNIQUE FOR STACK DISPERSION MAPPING WITH TRITIUM. Environ. Res., vol. 2:72-76, 1968. 22 refs.

A technique for wide-area stack effluent dispersion mapping uses tritiated water vapor as a tracer. The sampler consists of indicating silica gel in a fiberglass-screen bag conveniently placed in the field along sampling legs radiating out from the source. The adsorbed water vapor is removed from the silica gel by vacuum distillation and the tritium content is determined by liquid scintillation counting. This technique was used successfully to distances 10 miles from a source to determine the maximum ground level concentration of a stack effluent from a nuclear fuels reprocessing plant which already contained some tritiated water. This concept should find much use in pinpointing sources of specific contamination in urban, suburban, and rural areas under a wide variety of meteorological conditions. It is also a simple, inexpensive system to use. The sampler can be located in any accessible area in the field or even indoors. Furthermore, there is no need for power sources, air-moving equipment, or measuring devices which can limit the areas to be mapped or the number of samples to be taken. The final determination of tritium in the water taken from the sampler is routine. If this analytical capability is not available, the service can be readily obtained commercially. There is no radiological hazard associated with the tritium concentrations necessary to assure precise measurements of dispersion patterns.

5807 APTIC NUMBER 15879

Gartrell, F. E. and S. P. Carpenter
AERIAL SAMPLING BY HELICOPTER. A METHOD FOR STUDY OF DIFFUSION PATTERNS. J. Meterol., 12(3):215-219, June 1955. 7 refs.

A method for studying atmospheric diffusion of stack gases is described which utilizes a continuous SO2 analyzer operated in a helicopter. The method was developed to overcome problems encountered in conventional diffusion studies at a large coal-fired steam-electric power plant. It was tested by numerous sampling flights which demonstrated the practicality of the helicopter-analyzer combination for sampling for SO2 atmospheric pollution. Although the representativeness of samplings from a helicopter is not fully established, the effect of the helicopter on the quantities measured by the procedure outlined is believed to be negligible. As experience in use of this method is gained, this will be checked by comparisons with results obtained by conventional sampling procedures. With appropriate instrumentation, the method would be applicable to sampling for other atmospheric pollutants as well as SO2. The method has a number of advantages over conventional ground-sampling techniques, which make it particularly suitable for diffusion studies. These advantages include the rapidity with which down-wind sampling can be done, both aloft and near ground level, for considerable distances from the source; the greater accuracy with which the height and direction of the plume during the sampling period can be determined; and the ease with which otherwise practically inaccessible areas can be reached. The method provides information of a type heretofore unavailable and shows promise of being especially useful in diffusion studies. The analyzer has a threshold sensitivity as low as 0.1 ppm SO2. Response to changes in concentration is within 30 sec. The analyzer is calibrated approximately once a month, and the accuracy of SO2 determinations is within about 10%.

5408 APTIC NUMBER 15602

Grigorescu, I. and I. Csizek
THE UTILIZATION OF AUTOMATIC 'IONOFLUX'-TYPE ANALYSERS FOR DETERMINING THE HCN IN A HYDROCYANIC ACID FACTORY. (Utilizarea analizoarelor automate tip 'ionoflux' la dozarea HCN intr-o fabrica de acid cianhidric). Text in Romanian. Rev. Chim., 20(6):381-383, 1969.

Manual detection of HCN with a Drager-type tube, using color-reactive dyes, is rapid (1-2 min.) but of low accuracy (plus or minus 30%). An 'Ionoflux' automatic analyzer gives continuous, accurate surveillance, either at a single check point or at several points in programmed intervals (using a distributor), alerting maintenance to escaping gas. Protection against small variations in the electrolyte is provided by a double-cell system: measuring cell (exposed to air samples) and comparison cell (not exposed). Interpretation is made by a bridge circuit. Protection against 'false alarms' caused by other gases (e.g., ammonia) is provided by a filter consisting of silica gel saturated with concentrated H2SO4 and encased in glass.

5409 APTIC NUMBER 14828

Hadzija, Olga
ABSORPTION IN MICROANALYSIS. IV. ADSORPTION PROPERTIES OF SILICA GEL IN SIMULTANEOUS DETERMINATION OF CARBON, HYDROGEN, AND IODINE OR CARBON, HYDROGEN AND SULPHUR. Mikrochim. Acta (Vienna), no. 5:1110-1116, 1969. 2 refs.

A simple gravimetric method is described for simultaneous microanalytical determination of carbon and hydrogen together with sulfur, bromine, or iodine, in non-nitrogenous compounds. Commercial silica gel is used as the external absorbent for sulfur dioxide and halogens at room temperature. Under these conditions, sulfur dioxide does not oxidize to sulfur trioxide. The increase in weight of the silica gel tube corresponds to sulfur dioxide formed from which the percentage of sulfur can be calculated. One silica gel layer can be used for 4-5 analyses, provided that the first analysis is that of a sulfur-containing compound. The method does not work for nitrogen-containing compounds.

5410 APTIC NUMBER 15752

Watterer, Andre and Michel Porissier
PSEUDOCHROMATOGRAPHIC MICROANALYSIS UTILIZING GAS-SOLID EQUILIBRIA. DETERMINATION OF NO2, NOCl, Cl2, HCl, CO2 AND H2O. (Microanalyse pseudochromatographique utilisant les equilibres gaz-solide. Dosage de NO2, NOCl, Cl2, HCl, CO2, H2O). Text in French. Z. Anal. Chem., vol. 247:266-271, Oct. 1969. 12 refs.

Gas separation was carried out in two stages, condensation and sublimation, in a small metal tube exposed to a temperature gradient from 77 to 300 K. A non-condensable gas such as helium, hydrogen or nitrogen was used as a carrier. In the first stage, the components of the mixture were selectively solidified in the cooled tube under partial pressures below those of the triple points. In the second stage, heating of the tube with an inverted temperature gradient caused sublimation and completes the separation. Catharometers or mass spectrometers were employed for the detection and determination of the gases. Gases could be determined in the range of 0.000001 to 0.0001 mole/ml of gas. (Author abstract modified)

5411 APTIC NUMBER 15639

Hayes, Janet V.
COMPARISON OF THE ROTOSLIDE AND DURHAM SAMPLERS IN A SURVEY OF AIRBORNE POLLEN. Ann. Allergy, vol. 27:575-584, Nov. 1969. 15 refs.

An intermittent rotoslide and two Durham samplers were operated simultaneously for five months in 1962 on top of a 170-ft building. The rotoslide was operated for 2.5 min every half hour. One Durham sampler was oriented with the long axis of the slide in the north-south direction, and the other east-west to eliminate the effect of wind direction on the combined catch of pollen. The rotoslide collected larger quantities of pollen than the Durham samplers and gave data with greater statistical reliability; pollen counts from the rotoslide were often high enough to be significant at the same time that a Durham sampler collected little or no pollen. The rotoslide also catches a greater variety of pollen and detects seasonal patterns of occurence more successfully than a Durham sampler. As indicated by variations in the daily ratios between the samplers, wind speed and direction and atmospheric turbulence and precipitation affect the samplers differently. There is no factor that can be used to convert data from Durham slides to the concentrations measurable with the intermittent rotoslide. Operational difficulties of the rotoslide sampler are few and easily corrected, while the ordinary microscope slides are conveniently stored and handled. The technique of removing the rotoslide samples from the slide edges provides satisfactory optical qualities for pollen identification.

5412 APTIC NUMBER 15573

Heller, Arnold and Helmut Kettner
SAMPLING AND ANALYSIS OF TRACE AMOUNTS OF LEAD IN THE AIR. (Probenahme und Bestimmung kleinster Bleimengen in der Luft). Text in German. Schriftenreihe Ver. Wasser Boden Luft-hyg. (Berlin), no. 29:3-50, 1969.

For the lead analysis of air, samples were taken intermittently with a high-voltage sampler. Fiberglass was used as the filter medium and sampling lasted one hour. From the weight increase of the filter and the average air throughput, the dust concentration was calculated. The loaded fiberglass filter was boiled in nitric acid for 10 min, and the lead and part of the dust were dissolved. The solution was filtered and analyzed; the prepared sample was adjusted to the proper pH and mixed with 2 ml of a dithizon (diphenylthio carbazone) solution and vigorously shaken for 20 sec, after which the phases were separated. This process was repeated a maximum of two times. The excess dithizon was removed and the lead dithizonate was photometrically analyzed. With this method, lead quantities from 10 to 80 microns can be analyzed well. The

standard deviation at 10 microns was 5.7% and 1.5% at 60 microns. To determine the lead content of atmospheric air in the cities Muelheim (Ruhr), Duesseldorf, Neuss, Duisburg and Wuppertal, a total of 285 samples were taken and analyzed by this method. The samples were taken 1 m above the pavement and 50 cm to the side of the road. The measure lead concentrations fluctuated between 0.5 and 12.5 micrograms/cu m. Most concentrations were between 1 and 4 micrograms/cu m. No correlation between the lead concentration and traffic density was found.

5813 APTIC NUMBER 14502

Her Majesty's Factory Inspectorate, Dept. of Employment and Productivity
METHODS FOR THE DETECTION OF TOXIC SUBSTANCES IN AIR. OZONE IN THE PRESENCE OF NITROUS FUMES. London, Her Majesty's Stationery Office, Booklet 18, 1969, 10p. 8 refs.

The occurrence, toxic effects, and detection of ozone are reported. Ozone is present in very small quantities in the atmosphere, and following and during electrical storms, it may reach sufficiently high concentrations to be recognizable by odor. It is used for water sterilization, bleaching of oils, paper, and flour, and combating odors in place of proper ventilation. Ozone is formed industrially during high-tension, non-sparking discharge in air or oxygen, during electrical etching of polyethylene film, and during electric arc welding using an inert gas cover. Toxic effects include headache or respiratory irritation at low concentrations, and pulmonary edema and inflammation of the lung which are delayed and are found at concentrations as low as 1 ppm. The method for detection of ozone is based on the ability of cotton wool to remove ozone quantitatively from an atmosphere without affecting its nitrogen dioxide content. The analysis of an atmosphere both with and without passage through a cotton wool plug will give a measure of the ozone concentration present. A starch-iodine colorimetric procedure is employed for quantitative estimation by comparison with glass color standards.

5814 APTIC NUMBER 14550

Hersch, Paul A.
GALVANIC AIR POLLUTION MONITORING, AIDED BY CATALYSIS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 353-362. 3 refs.

Several galvanic systems that can serve as simple, sensitive, and selective analyzers for continuous air pollution monitoring operations are briefly described. One such system involves combining a partly gas-exposed cathode with a stagnant alkaline electrolyte and a base metal anode; in other systems, the electrolyte may in some cases be advantageously recirculated, using the sample air stream for lifting the liquid. Cells have been developed for monitoring carbon monoxide, nitric oxide, ozone, and sulfur dioxide. Thus, all the major pollutants except hydrocarbons can now be monitored by galvanic systems; sensors for aldehydes and olefins are likely to follow. The cells avoid pumping liquid reagents into the analyzer and disposing of spent reagent. They also avoid the temperature dependence and inherent instability of membrane-covered 'polarographic' sensing devices. Without a membrane barrier, a major portion and sometimes all of the sampled, electromotively-active species reaches the electrode. The importance of the relation between galvanic air pollution sensors and catalysis is discussed. The pollutant may enter a catalytic reaction, depending on the electrode it contacts, or it may itself act as a catalyst. Catalysis is involved in calibration procedures and may help in making an analyzer more specific. Catalysts also have an important place in precursor-reactors which convert an analytically intractable constituent to one that is more readily amenable to determination.

5815 APTIC NUMBER 14802

Hochheiser, Seymour and Lawrence A. Pfiers
AUTOMATIC SEQUENTIAL SAMPLING OF ATMOSPHERIC H2S BY CHEMISORPTION ON MERCURIC CHLORIDE-TREATED PAPER TAPE. Preprint, Public Health Service, Durham, N. C., National Air Pollution Control Administration, 20p., 1969. 6 refs. (Presented at the American Chemical Society, 157th National Meeting, Minneapolis, Minn., April 1969.)

Atmospheric hydrogen sulfide concentrations of 0.5 to 100 ppb were conveniently monitored using an automatic, sequential, filter paper tape sampler and mercuric chloride-treated paper tape. This method is especially suited to field sampling because no liquid reagents are employed, the samples obtained are stable over long periods of time, and a single roll of tape is sufficient for collecting consecutive 2-hr samples over a period of one month. The color developed with ammonia may be analyzed up to 8 hrs after development without significant loss in absorbance. The air sample must be moisturized for efficient reaction with the chemically treated tape; however, use of glycerol in the impregnant decreases moisture dependency. None of the gases investigated for interference will normally interfere in atmospheric hydrogen sulfide measurement. The disadvantages of the lead acetate tape method were overcome by modification in sampler design and by use of mercuric chloride reagent.

5816 APTIC NUMBER 15204

Hockings, W. A.
PARTICLE AND GRAIN-SIZE MEASUREMENT BY X-RAY FLUORESCENCE. Powder Technol. (Amsterdam), 3(1):29-40, Oct. 1969. 7 refs. (Presented at the International Conference on Powder Technology, Chicago, May 20-23, 1968.)

This method of particle size measurement is based on the fact that the intensity of fluorescent X-rays from an element in a particle is dependent on particle size. The effect can be expressed by the intensity ratio R, the ratio of the intensity from a sample containing particles of size S to the intensity from a sample

containing particles of zero size, both samples having the same concentration of the fluorescing element. An equation relating P and S was derived for low concentrations of cubic particles suspended in a matrix material. The equation predicts that P will depend only on the particle size, the sample thickness, and the linear absorption coefficients of the particle and matrix materials. Experiments were conducted using closely-sized fractions of W, Cu, and bronze powders in various matrices. It was found that by varying the incident X-rays, the matrix material, and the fluorescent X-rays, the sensitivity of P to different ranges of particle size can be controlled. The intensity ratio was found to decrease with particle concentration and small deviations in linearity were found for mixtures of particle sizes. The experimental results were in fair agreement with the equation. The method is rapid and non-destructive, requires only a small amount of sample, and permits measurement of the sizes of different particle species in a single sample. It appears to be particularly attractive for rapid, routine measurements of average particle size on many commercial powders, as well as for grain size measurement on alloy and rock samples. It appears possible to use the method for on-stream particle size measurement of suspensions. (Author summary modified)

5817 APTIC NUMBER 15708

Hoffmann, Dietrich, Yoshito Masuda, and Ernest L. Wynder
A-NAPHTHYLAMINE AND B-NAPHTHYLAMINE IN CIGARETTE SMOKE. Nature, 221(5177):258-256, Jan 18, 1969. 8 refs.

Epidemiological data suggest an association between cigarette smoking and urinary bladder cancer in men. Identification in cigarette smoke was made of A-naphthylamine and B-naphthylamine, which are known experimental bladder carcinogens. For the quantitative analysis, A and B-naphthylamines labelled with 14C were used as internal standards. Samples isolated chromatographically were subsequently identified by mass spectrometry.

5818 APTIC NUMBER 10835

Holzhey, Joachim and Horst Dennrich
A RADIOMETRIC DEVICE FOR CONTINUOUS CONTROL OF FLUE DUST CONCENTRATION. (Ein radiometrisches Gerset zur kontinuierlichen Kontrolle des Gichtstaubanfalls). Text in German. Neue Huette, 14(4):199-201, April 1969. 2 refs.

A radiometric method based on radiation absorption which can be used for determining the flue dust concentrations in furnaces is described. Gamma or X-rays are used for the measurements. The equipment consists of a radiation transmitter on one side of the flue duct and radiation detector on the other side. Since the ducts are rather thick-walled, drillings of 8 and 25 mm in diameter are necessary; they are sealed by windows. The measurements were conducted with a radiation energy of 10 keV, and with an anode current of 1mA. The results are graphically illustrated by a plot of the radiation extinction as a function of the dust concentration. Since the dust composition was unfavorable with respect to the mass extinction coefficient, absorption of the X-rays was minor. Disregarding the fact that insufficient individual measurements were taken, a dust measurement error of roughly plus or minus 5 g/cu m was obtained. These measurements were taken on an experimental set-up, where air was drawn through a pipe to which certain quantities of dust were added. To illustrate the method in practical use, measurements were also taken in the downward flue a furnace. Aside from dust deposition at the radiation inlet window, no problems were encountered, although a final conclusion must be withheld, since test measurements are still being made.

5819 APTIC NUMBER 15705

Hoover, Gary W. and Dudley Williams
INFRARED ABSORPTANCE OF CARBON MONOXIDE AT LOW TEMPERATURES. J. Opt. Soc. Am., 59(1):28-33, Jan. 1969. 27 refs.

Detailed knowledge of the infrared absorptance of atmospheric gases is important in meteorology and astrophysics and gives valuable information regarding intermolecular forces. The strengths and half-widths of lines in the P branch of the CO fundamental band at temperatures as low as 113 K have been determined from equivalent-width measurements in the linear and square-root regions of the curve of growth. For all temperatures, the observed line strengths are in excellent agreement with line strengths calculated on the basis of the Herman-Wallis expression. However, at the lowest temperatures the observed half-widths differ considerably from the values calculated on the basis of the usual extrapolations of room-temperature data; the half-widths of lines near the band center are much larger than the calculated half-widths, and the half-widths of lines in the band wing are apparently considerably smaller than the calculated half-widths. (Author's Abstract Modified)

5820 APTIC NUMBER 15203

Hunt, C. W. and A. R. Woolf
COMPARISON OF SOME DIFFERENT METHODS FOR MEASURING PARTICLE SIZE USING MICROSCOPICALLY CALIBRATED GLASS BEADS. Powder Technol. (Amsterdam), 3(1):9-21, Oct. 1969. 55 refs.

Measurements of particle size distribution by the microscope and by a number of other methods were compared using samples of glass beads from a single blended batch as the reference material. The other methods included a Coulter counter, electroformed sieves, the Andreasen pipette, and the Roller analyzer. Surface average particle size calculated from microscopic and Lea-Nurse air-permeability measurements were also compared. As an independent check of diameter measurements with the microscope, comparisons were made with an interferometer, using fibers drawn from a melt of the same glass. These comparisons afforded an opportunity to assess some of the sources of error in each of the methods. Differences between the averages of results obtained with the microscope and those obtained with the Coulter counter, the Lea-Nurse apparatus, and the Andreasen pipette, as well as the interferometer, were comparable in magnitude with the normal statistical variations inherent in the methods themselves. However, small systematic biases were observed. Agreement between

results by the microscope and the Roller analyzer was satisfactory, although the latter is subject to greater uncertainties than the other methods investigated. Disagreements were obtained with fine electroformed sieves, which passed more material than predicted from the size distribution by the microscope. (Author summary)

5421 APTIC NUMBER 15386

Iinoya, Koichi, Shin-ichi Yuu, Kazutaka Makino, and Kazuhiko Nakano
ON MEASUREMENT OF PARTICLE SIZE DISTRIBUTION BY CASCADE IMPACTOR; IN CASE OF SPECIFYING THE CLEARANCE RATIO THREE FOR ROUND NOZZLE. (Kasukeido-impakuta ni yoru ryudo sokutei ko no mondaiten; enkei nozuru kankaku-hi 3 no baai). Text in Japanese. Kagaku Kogaku (Chem. Eng.), 33(7):689-695, July 1969. 4 refs.

The weight of small particles can be measured by the use of a cascade impactor within the smoke duct. The cascade impactor used in this case had a series of six nozzles, the diameters of which ranged successively from 0.526 to 0.112 cm, and the distance between each nozzle and its collection plate was fixed at three times the length of the nozzle diameter. A millipore filter was used after the smallest nozzle to collect the smallest residual particles. The experimental particles were fly ash and mica powder. Particles of all sizes were sent from the largest to the smallest nozzle. At each stage, all particles larger than the nozzle diameter and 50% of those having the exact size of the nozzle could not pass through and were collected on the plate; the smaller particles all passed through, and the process was repeated at each nozzle until the millipore filter was reached. It was found that a partial separation efficiency curve obtained with an aerosol of a single kind of particles can be adapted to aerosols containing many types of particles. Separation efficiency was reduced by backscattering; the minimum weight of collected particles which causes backscattering increased with particle size. The diameter of the aerosol particles can be measured by using a cumulative separation efficiency curve.

5422 APTIC NUMBER 15645

Imaisumi, Tatsumi, Sadanori Kitahara, and Akira Obura
AIR POLLUTION TELEMETRY SYSTEM. (Taiki osen kanshi teremeta sisutemu). Text in Japanese. Mitsubishi Denki Giho (Tokyo), 43(8):1112-1116, Aug. 1969.

The air pollution telemetry system used in Nagoya, Japan, observes the severity of air pollution and ambient meteorological conditions in a wide area. The telemeter uses a silicon transistor and a wireless circuit with a frequency of 800 MHz in order to alert observers in several areas of the city by wireless digital or automatic telemetry. The system observes the sulfur dioxide, dust, wind direction and velocity, and temperature. These data are sent to the central telemeter station and automatically displayed on a panel. The severity of air pollution is shown by different colors according to the concentration of SO2 or dust. This telemetry system is a convenient and excellent procedure for observing air pollution and should be used in many other polluted cities.

5423 APTIC NUMBER 16525

Innes, W. B.
SELECTIVE COMBUSTION ANALYSIS AND APPLICATION TO AUTO EXHAUST. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 363-382. 4 refs.

The application of a vanadia catalyst to hydrocarbon analysis is discussed. The combination of hydrocarbon-carbon monoxide analysis involves a second parallel reactor with a Hopcalite catalyst. Air with constant moisture content passes through a temperature-controlled preheater and catalyst bed at a constant flow rate, and the gas sample is added to the air stream in a small quantity. A review of California data indicated that the idle mode was reasonably good for predicting pass/fail hydrocarbon emission levels and that it could be correlated with cyclic values on a statistical basis. About 300 cars were tested at local service stations, car washes, and dealerships which were believed to be representative of the Los Angeles basin car population. About 200 cars were also tested in car clinics. The results suggested that over half the emissions can be attributed to the high emitters (greater than 1000 ppm), most of which are believed to have defective ignition systems. The effect of routine tuneup by tuneup specialists on emissions was also studied. The results, in line with other studies, suggest that cars with reasonably low emissions are not helped and emissions may even increase, and that the average degree of improvement from a professional tuneup is proportional to how much the levels exceed that of a car in good shape. Together with the distribution data, they suggest that an effective check and correct program could lower emissions by as much as 50%.

5424 APTIC NUMBER 15277

Institut National de l'Industrie Charbonniere, Liege, Belgium
DESIGN OF A METHOD OF SAMPLING AND MEASURING HEAVY HYDROCARBON CONCENTRATIONS IN COMBUSTION GASES. (Mise au point d'une methode de prelevement et de dosage des hydrocarbures lourds dans les fumees de combustion). Text in French. Bull. Tech. Houille et Derives, no. 36, 15p., March 1968.

A method was devised for sampling and measuring heavy hydrocarbons in combustion smokes. The sampling technique is based on the adsorption of the hydrocarbons on a short adsorbent column placed within the chimney itself. The smokes can be drawn up through the sampling tube in less than one minute with the help of a rubber syringe of the 'Propipette' type. To measure the hydrocarbons collected, the sampling tube is inserted in a carrier gas circuit which also includes a flame ionization detector. The tube is brought to a high temperature in a mobile oven. The hydrocarbons are desorbed and carried by the carrier gas towards the detector; there is no separation of the hydrocarbons, and the response appears in the form of a single

peak on the recording paper. It is possible to desorb hydrocarbons with a boiling point above 500 C, and it has been demonstrated that no cracking occurs. The drainage output, which depends on the boiling temperatures of the sampled hydrocarbons, is excellent and can be still further improved if, prior to the sampling, the tube is cooled to the temperature of the dry ice. With regard to sensitivity, it was demonstrated that, in the case of anthracene, quantities equal to 0.000001 g produced a peak the area of which allowed a precise measurement to be made. The method also makes it possible to carry out a detailed analysis of the sample and determine the individual concentrations of the various components. For this purpose, a chromatographic column must be inserted into the carrier gas between the sampling tube and the detector. Several examples of the determination of total and individual concentrations are given in various fields: synthetic mixtures, combustion smokes, cigarette smokes, and automobile exhaust gas. The possibility of applying the method to the measurement of benzo(a)pyrene is being considered. In variation, a secondmethod of assessing the sample by methanol elution followed by a spectrophotometric examination is described.

5825 APTIC NUMBER 13621

Institute of Sanitation Engineering, Sursan (Brazil), Pollution Control Div.
LEGISLATION AND INSTRUCTIONS ON THE SMOKE EMISSION OF DIESEL-OIL POWERED VEHICLES. (Legislacao e instrucao sobre emissao de furnaca nos veiculos movidos a oleo diesel.) Translated from Portuguese. 20p., April 1967. 2 refs.

This monograph discusses (1) the Ringelmann chart, (2) a smokescope, which is proposed to compensate for some of the disadvantages of the Ringelmann chart, (3) air pollution control regulations in Guanabara, Brazil, (4) the amounts of fines for noncompliance to air pollution regulations, (5) a disciplinary code for the restriction of emissions from motor vehicles, (6) a new national code regulating motor vehicles, and (7) the problem of placement of exhaust pipes on motor vehicles.

5826 APTIC NUMBER 18876

Ixfeld, H.
METHOD FOR DETERMINING ORGANIC SUBSTANCES IN WASTE GASES. (Verfahren zur Erfassung organischer Substanzen in Abgasen). Text in German. Brennstoff-Chem. (Essen), 50(6):186-189, June 1969. 4 refs.

The method of Ixfeld and Buck for quantitative determination of organic substances in waste gases (with the exception of the hydrocarbons C1-C8) can be improved if the samples are carefully taken and prepared. This improvement is illustrated by the example of waste gases from a lacquer-drying stove. The waste gases from these stoves are usually cleaned in catalytic afterburners. The partially clean gases contain much higher fractions of CO2 (50 to 100 g/cu m) and water vapor (20 to 50 g/cu m) than the uncleaned waste gases. These high concentrations may have a considerable influence on hydrocarbon analysis by the Ixfeld and Buck method. To determine the magnitude of this influence, CO2 and synthetic air were mixed in a 1:1 ratio and freed of combustible organic substances. The gas mixture, cooled to room temperature and saturated with water vapor, was passed for 10 min through a silica gel tube. The tube was tightly sealed afterwards and left to rest for periods of up to 24 hrs. After that it was flushed for 5 min with nitrogen and desorbed. The desorbed CO2 quantity was proportional to the length of time the silica gel tube rested. The optimum resting period between the two flushings was 6 hrs. After this period, further reduction of the remaining CO2 content was found to be negligible. The nitrogen flushings did not influence analysis of the adsorbed organic substances. Similar experiments were conducted to determine the influence of H2O. So-called FN silica gel was used as the adsorbent and hexane as the organic component with synthetic air. The measurement errors increased with water content. Lowering of the gas throughput in the same sampling time brought no improvement. Aerosols can be better sampled if glass fiber filters are inserted ahead of the silica gel tube.

5827 APTIC NUMBER 18658

Jaeger, J. and O. Lugrova
DETERMINATION OF 3,4-BENZPYRENE IN A MIXTURE BY FLUORESCENCE SPECTROGRAPHY AT THE TEMPERATURE -197 C. (Stanoveni 3,4-benzpyrenu ve smesi pomoci fluorescencni spektrografie za teploty -197 C). Text in Czech. Chem. Zvesti, 19(10):778-782, 1965. 18 refs.

Analysis of aromatic polycyclic compounds is made possible using fluorescence spectrography at very low temperatures. Suitable solvents are chosen from the normal paraffin series. Under this condition, the spectrum has very sharp peaks, comparable to atomic absorption spectra. The presence of the substances can be detected even if they exist as traces in concentrations of 10 to the minus 11th power to 10 to the minus 9th power g/ml. 3,4-benzpyrene gives a sharp maximum at 4030 A at a concentration of 10 to the minus 11th power in 1 ml of octane. The test is carried out on a thin sheet of aluminum oxide. A standard solution of pure 3,4-benzpyrene is added to the specimen so that after the dilution, the limit of 0.15 micrograms/ml is not exceeded. To keep error lower than 8%, absorption of the solution should never be higher than 0.017 for 1 cc of solution at 3650 A. The other sources of measurement error are high concentration, unsteady current in the source of radiation, error in freezing the dilution, and error of dilution.

5828 APTIC NUMBER 15733

Jerman, L. and F. Jettmar
POLAROGRAPHIC DETERMINATION OF SELENIUM AND SELENIUM DIOXIDE IN THE AIR OF WORKSHOPS. (Polarographische Bestimmung von Selen und Selendioxid in der Luft von Arbeitsraumen). Text in German. Z. Ges. Hyg. (Berlin), 15(10):738-737, Oct. 1969. 11 refs.

A polarographic method for determining selenium and selenium dioxide in air was described. Suspended particulates containing

selenium were obtained with membrane ultra-filters. Glass frit absorbers with a sodium hydroxide (1N) absorbent were used to obtain selenium dioxide. The ultra-filters were mineralized with nitric acid. A conducting solution of sulfuric acid (8N) was added to the samples and the concentrations were recorded. The results showed that concentrations of selenium and selenium dioxide which are below the maximum permissible level can be determined with this method. (Author summary modified)

5829 APTIC NUMBER 15529

Johnson, J. R., W. F. Hastead, and W. D. Smith
NUCLEAR SUBMARINE ATMOSPHERES. PART 2. DEVELOPMENT OF A TOTAL HYDROCARBON ANALYZER. (Interim Report). Naval Research Lab., Washington, D. C., Chemistry Div., NRL Problem C08-30,P05-24B, C08-11, Projects SR-013-09-01-4092-0095, WW-041, SR-89022, NRL 6068, 5p., Jan. 30, 1968. 12 refs.
CFSTI: AD 841181

An instrument was developed for the shipboard monitoring of total hydrocarbons in nuclear submarine atmospheres. In addition to total hydrocarbons, the instrument also measures methane and Freon-12 and, with a slight modification in operating procedure, Freon-11. The system is based on a chromatograph technique coupled with a highly sensitive flame ionization detector. An air sample is injected into a chromatographic column and chromatographed in the usual manner until the methane and Freon-12 peaks emerge. At this point, the flow of carrier gas is reversed and the higher hydrocarbons are backflushed from the column through the detector as a single peak. The area under the backflushed peak provides a measure of the total atmospheric hydrocarbon content. The instrument was successfully tested at sea, with hydrocarbons detected within a few minutes. The analyzer is relatively insensitive to interference by water, CO2, and other organic gases.

5840 APTIC NUMBER 10758

Jungreis, E. and D. W. West
MICRODETERMINATION OF LEAD BY THE RING-OVEN TECHNIQUE APPLICABLE TO AIR POLLUTION STUDIES. Israel J. Chem., 7(3): 811-816, 1969. 3 refs.

The normal average of lead concentration in a permissible working atmosphere is 0.15 mg/cu m. The toxicity of the various lead compounds appears to depend on their solubility in body fluids and the fineness of the particles, with the solubility increasing in proportion to the fineness of the particles. As a result, the metallic lead fumes, the carbonate and the monoxide, are considered more toxic than the coarser lead dust, and phosphate, sulfide, and chromate compounds. A method for the microdetermination of lead which differentiates between the two groups of compounds by the ring-oven technique is described and is believed applicable to lead analysis of air pollution samples collected on sequential tapes. The method consists of fixing a filter paper on a ring-oven maintained at 100-105 C, adding the sample solution and then washing it out of the ring with 1 N nitric acid or acetic acid 1:5 solution. After completely drying the paper and evaporating the acid, 10 microliters of sodium molybdate solution is washed out; the dried paper is then placed in a malonic acid bath, boiled twice, dried, coated with a diphenylcarbazide reagent solution, and fumed with concentrated hydrochloric acid for about 5 min. The appearance of a blue ring indicates the presence of lead. As the colored background turns slowly from red to yellow, one hour should elapse before comparison with standard rings. The method for calculating the concentration of the unknown sample is given. The lower limit for lead determination was 0.05 micrograms; the upper limit for accurate estimation was 2 micrograms. Interference by other metals is briefly considered. It is concluded that two parallel determinations using nitric acid and acetic acid to dissolve lead particles will give basic information as to their hazardous or less hazardous nature, the first one marking the total lead value, the second the 'hazardous' one.

5831 APTIC NUMBER 15677

Jutzi, W.
TESTING OF METHODS FOR REDUCTION OF ODOR EMISSIONS. (Pruefung von Verfahren zur Reduktion von Geruchsemissionen). Text in German. T. Praeventivmed., 14(5):305-306, 1969. 1 ref.

The Swiss Federal Material Testing Institute for Industrie and Construction (EMPA) developed a new method for determining the odor intensity of emissions. Large, continuous samples of the waste gas are mixed with fresh air. The latter is cleaned with activated charcoal prior to its use. The mixture is passed through a steel or plastic pipe of about 80 cm inside diameter to the persons judging odor intensity. This method is more complicated than the common method of obtaining one sample, mixing it with clean air, and having a test person determine the odor intensity but it is more easily reproducible and more representative. Two such pipes are used to judge the efficiency of a method for the reduction of odors.

5832 APTIC NUMBER 15563

Kettner, H.
COMPARATIVE DETERMINATIONS OF LEAD IN DUST PRECIPITATIONS BY THE DITHIZON AND ATOMIC ABSORPTION SPECTROPHOTOMETRIC METHODS. (Vergleichende Bestimmungen von Blei in Staubniederschlag nach der Dithizon- und der Atom-Absorptions-Spektral-Photometer-Methode). Text in German. Schriftenreihe Ver. Wasser Boden Lufthyg., no. 29:55-62, Oct. 1969. 2 refs.

By the use of atomic absorption spectrophotometry, 380 determinations were made in less than three hours. The method was reproducible, selective, and easy to calibrate. Calibration measurements using 10 micrograms lead per ml showed that the standard deviation was less than 2%. Cations such as Fe(3+), Al(3+), Ca(2+), Mg(2+), and Na(+), which occur in concentrations 100 to 1000 times that of lead, did not interfere with the analysis. The samples used for the analyses were prepared as follows: the dust sample was boiled with 50 ml dilute HCl and several drops of nitric acid. After cooling it was diluted

to 250 ml. The clear solution which separated was used for the analyses. The results of the determinations by both chemical and spectrophotometric methods are listed in a table. Calculation of the correlation coefficients showed that atomic absorption spectrophotometry is applicable to the determination of small lead concentrations; correlation with the dithizone method is 99.6%.

5833 APTIC NUMBER 15576

Kettner, Helmut
MEASUREMENT OF THE SOOT CONTENT OF DUST PRECIPITATIONS.
(Bestimmung des Russgehaltes in Staubniederschlaegen). Text in German. Gesundh. Ingr., 89(7):215-216, 1968. 2 refs.

To determine whether the dust emitted by a non-ferrous metal fabricating plant could be considered a nuisance, the dust fall was measured by the Loehner-Liesegang method. Evaluation of the measurements showed that the maximum annual average was 625 g/100 sq m/month, i.e., 62.5% of the maximum allowable concentration in residential areas. This method, however, was found to be inadequate in this case. The dust contained high amounts of soot which were disregarded in the quantitative determination of dust fall. Therefore, another method was developed for a separate soot determination. The dust sample was set aside for awhile to allow the soot to precipitate. The clear water was then removed and the precipitate was dried at 105 C and weighed. To eliminate all interfering substances, several milliliters of 2N HNO3 and several drops of 30% hydrogen peroxide solution were added to the residue, which was briefly boiled. The soot is not decomposed by these reagents. The solution was acidified, filtered, and air dried, and the color intensity was compared with a calibrated soot shade scale. From the value obtained by this method, the soot content can be computed.

5834 APTIC NUMBER 15618

Kettner, Helmut
THE REAGENT BLANK VALUE IN THE DETERMINATION OF SMALL LEAD CONCENTRATIONS IN ATMOSPHERIC AIR. (Ueber den Reagenzienblindwert bei der Bestimmung von kleinen Bleimengen in der atmosphaerischen Luft). Text in German. Schriftenreihe Ver. Wasser Boden Lufthyg., (29):51-58, 1969. 1 ref.

During closely successive lead analysis, the extinction decreased stepwise but returned to its inital value after several days. This lead to the assumption that the blank value steps from lead liberated from the glass material. To confirm this, the blank value was determined with lead free glass vessels and polyethylene flasks. The results of this study showed that in the majority of cases, the extinction was below 0.010, even with the addition of fourfold the required reagent, i.e., in a range where the analyzer begins to measure inaccurately. The lead amount introduced by the reagents was negligibly low. The reagent blank value resulted primarily from the lead of the glass vessels.

5835 APTIC NUMBER 18953

Kimura, Yikuzi
ON THE 'AIRBORNE' PARTICULATE POLLUTANTS'. (Taikiosen ryuujobutsu ni tsuite no kento). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 45(11):625-638, Nov. 1969. 60 refs.

Results of studies on particulate pollutants are presented. Two types of measuring instruments were used: one for evaluating pollutant concentration and the other for weighing the pollutants. The former includes the tape air sampler, the long-term recording impactor, and the digital dust indicator. The latter includes the high-volume air sampler. Measurement of concentration expressed by the number of particles per unit volume and the study of particle size distribution and shape were made with the Roken dust counter, the thermal precipitator, and the cascade impactor. Results so far obtained disclosed that the pollutant concentration changed remarkably from hour to hour and from day to day. Electron microscopy revealed that the shape and size of particles varied markedly depending upon the air pollution source and weather. The number of particles per unit volume of air largely differed according to the type of sampler used and the resolving power of the microscope. For this reason, the use of the gravimetric method is recommended. Importance of measuring size and shape of particles, as well as chemical properties, is emphasized. Air pollutants are a mixture of particulate and gaseous matter. Inhalation of the total mixture is more damaging to the respiratory tract than the individual components of the mixture. In evaluating air pollution, therefore, it is important to consider the mixture as a whole.

5836 APTIC NUMBER 18485

Kimura, K.
ON THE DETERMINATION OF AIRBORNE CIGARETTE SMOKE (REPORT 2). (Fuki chu ni fuyu suru tabacco no kemuri no soku tei (Dai 2 ho)). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):84, April 1969.

Measurement of airborne cigarette smoke, as distinguished from soot, was attempted. Cigarette smoke has a maximum absorption at approximately 370 millimicrons and a minimum at approximately 600 millimicrons. The concentration of cigarette smoke in airborne particulates can be determined by the ratio of transmission rates of two wavelengths for a sample. Samples are collected by a glass fiber filter with a 1 cm collection surface area, and the smoke's transmission rates are measured by a photoelectric colorimeter. Transmission rates of cigarette smoke and carbon particles (black smoke released when burning benzene) are then measured for wavelengths of 373 millimicrons and 625 millimicrons. Next, the relationship between the ratio of transmission rates for the two wavelengths and weight percentage of cigarette smoke in the airborne particulates is established. In the case of a smoking experiment, after producing carbon particles in a 27 cu m room, the concentration of cigarette smoke calculated from the transmission rate agreed fairly well with the values obtained by weighing. The variation of smoke concentration with respect to time obtained by this method

is fairly consistent with visual observation of smoking conditions.

5837 APTIC NUMBER 15200

King, W. H., Jr.
THE CONTINUOUS MEASUREMENT OF HYDROGEN, METHANE, AND HYDROCARBONS IN THE ATMOSPHERE. Preprint, American Chemical Society, Washington, D. C., 20p., 1969. 3 refs. Presented at the American Chemical Society, 158th National Meeting, New York, Sept. 8-12, 1969.

Photochemically inert methane accounts for 90% of atmospheric hydrocarbons, and its large signal interferes with the flame ionization detection of active smog-producing hydrocarbons. To overcome this problem in hydrocarbon monitoring, automatic systems were developed which use a flame ionization detector or water sorption detector in conjunction with a selective catalytic combustor. The programmed combustor unit, consisting of a quartz tube containing a platinum wire coil, takes advantage of methane's inertness to analyze for it in the presence of hydrocarbons. The combustor can be utilized in three ways, each of which was evaluated for several months in the laboratory and in the field. One method involves the selective combustor and a flame ionization detector. An automatic zero level, methane, and total hydrocarbons are recorded by this method. In the second method, hydrocarbons are dried, combusted, and converted to water and carbon dioxide. The water is detected by a sorption detector. Hydrogen, olefins, paraffins, and methane are recorded. The third method is analogous to the second, except that carbon dioxide is determined, rather than water. The second method is preferred since no extra gases are required, calibration is simple, and equipment is portable and battery-operated. With this technique, 1.6 ppm methane, 1.5 ppm paraffins, and 1.9 ppm olefins and other reactive hydrocarbons have been recorded. However, it is expected that air monitoring stations with flame units will prefer the first method. The water sorption technique should gain acceptance if hydrocarbon monitoring becomes important.

5838 APTIC NUMBER 15632

Kiss, A. B.
CONTINUOUS DETECTION OF SIMULTANEOUS TG AND IR MEASUREMENTS OF NH3 AND H2O RELEASED IN THERMAL DECOMPOSITIONS. Acta Chim. Acad. Sci. Hung., 61(3):207-222, 1969. 17 refs.

The release of ammonia (NH3) and water vapors during thermal decomposition was measured as a function of time and temperature with an infrared spectrophotometer whose gas cell was connected to a sample holder of the thermobalance. The effects of sample weight, flow rate of the carrier gas, and heating rate of the furnace on the area under the maxima of the resulting curves were studied. Because of the lack of proportionality between the optical density and ammonia concentration, direct quantitative evaluation of NH3 control measurements was not possible; therefore, a calibration curve was constructed by plotting transmission against the amount of NH3 in the spectrophotometric cell. The curve shows that the total area under the infrared maxima is proportional to sample weight, i.e., to the amount of released NH4. The area under the curve is proportionally decreased by increasing the flow rate of the carrier gas. The water vapor measurement was performed by its secondary reaction with calcium carbide, and the maxima standardized with CuSO4-5H2O. The areas under the maxima of the IR curves are proportional to the corresponding amount of H2O, indicating that various types of water are converted to acetylene to the same degree. Additional information about the course of thermal decomposition was obtained by plotting TG curves and infrared maxima together for ammonium paramolybdate and ammonium paratungstate. The infrared measurements yield three maxima according to the TG curve; all three steps involve the simultaneous release of given amounts of NH3 and H2O. The maxima are located at the inflection points of the corresponding TG curves. The concentration of the gases in the cell gradually increases with an increasing loss of weight. From the inflection point to the beginning of the TG curve, the gas concentration, i.e., the absorption, gradually decreases. It is concluded that simultaneous infrared measurements help to identify the reaction which takes place at individual stages of the TG curve, especially when more than one gas is independently released during thermal decomposition.

5839 APTIC NUMBER 14925

Kitagawa, T.
DETERMINATION OF AIR POLLUTANTS WITH SO2 TEST PAPER. (Aryusangasu kenchishi niyoru taikiosen no sokutei). Text in Japanese. Fuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(2):9-17, June 1969. 5 refs.

A new method for determining a minute amount of sulfur dioxide with a test paper was developed. The paper, soaked with phenol red and dried, changed color from reddish purple to yellow on contact by dilute SO2. By considering both the degree of color change and exposure time, the quantitative measurement of SO2 concentration can be made to the order of 0.01-1.0 ppm. Effects of meteorological factors on the sensitivity to SO2 as an air pollutant were studied, and the paper proved to be useable with wind velocities over 1.5 m/sec and humidities over 35%. The sensitivity of the paper to NO2 was 35%, HCl 50%, and for acetic acid was the same as to SO2. The paper was insensitive to CO2, CO, and H2S. When exposed to SO3 mist, the change of color was not uniform, and yellow spots were observed. By a parallel test in the open field with the rosaniline-formaldehyde method, 80% of the whole measured value was found to be within a 20% error range. By making use of the test paper, daytime distributions of SO2 concentration in Yokkaichi, Yokohama, and Kawasaki cities were obtained.

5840 APTIC NUMBER 14974

Klainer, Stanley M.
THE MONITORING OF GASEOUS CONTAMINANTS IN THE ATMOSPHERE USING RADIOACTIVE CLATHRATE TECHNIQUES. Preprint, Laboratory for Electronics, Inc., Waltham, Mass., Tracerlab/Research Div. 10p., 1966. (Presented at the Symposium on Radioisotope Applications in Aerospace, Dayton, Ohio, Feb. 15-17, 1966.)

A toxic gas monitor was developed which uses radioactive clathrate techniques to detect certain reactive gases present in the atmosphere in the parts-per-million range. Fluorine, chlorine, chlorine trifluoride, sulfur dioxide, nitrogen oxide, nitrogen dioxide, amines, and ozone are among gases measurable by this technique. The use of clathrates for gas analysis is categorized as an inverse radioactive tracing technique. In this process the constituent to be analyzed undergoes a chemical reaction with a krypton-85 hydroquinone clathrate which results in the release of an active tracer gas whose concentration is proportional to the original species to be analyzed. Completely separate instruments are used for each gas even though many of the parts are redundant. Experience showed that a multigas system has much poorer operational characteristics than the single units. Most present day rocket fuels and oxidizers can be monitored efficiently by this technique. Fixed station and portable monitors are available. The output of the instrument is a simple electronic signal that not only activates a meter and a recorder, but also actuates controls and alarms for personnel or area safety. A lower detectable limit of 0.5 ppm was observed for most gases on a routine basis. For special situations 0.1 ppm was monitored. The upper limit of the instrument depends on the required cell life and the saturation characteristics of the Geiger tube. Gases which can directly or indirectly react with the clathrate are measurable. Advantages of the monitor include a completely dry system, better than one part-per-million sensitivity, and reliability.

5441 APTIC NUMBER 15338

Knipovich, O. M. and Yu. M. Emel'yanov
CONTINUOUS DETERMINATION OF OZONE CONCENTRATION IN GAS MIXTURES BY MEANS OF ITS HEAT OF DISSOCIATION. (Nepreryvnoye opredeleniye kontsentratsii ozona v gazovykh smesyakh po teplote yego razlozheniya). Text in Russian. Zavodsk. Lab. (Moscow), 35(8):960-965, 1969.

An analyzer was designed for continuous measurement of ozone in gas mixtures. Ozone dissociation is an exothermic process and the heat in the catalyzer is continuously recorded by means of a potentiometer. A sulfuric acid manometer was used to measure pressure drop. It was claimed that the unit operates effectively for up to two months. (Author abstract modified)

5442 APTIC NUMBER 18981

Kobayashi, Yoshitaka
A RAPID METHOD FOR MICRODETERMINATION OF SULFUR DIOXIDE IN AIR BY MEANS OF DETECTOR TUBES. (Fukichu no biryo sryusan gasu no kenchikan ni yoru donsoku teiryo ho). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), vol. 9:229-232, 1960. 8 refs.

Present methods for the determination of small amounts of sulfur dioxide in the air are inconvenient and time-consuming. For the rapid determination of SO2, a granular gel was used which changed colors when exposed to small amounts of SO2 in air. The reagent consisted of a purified silica gel impregnated with I2 solution and tetramethyl-diamino-diphenylmethane. The gel was placed in a glass tube and the air sample was drawn through the tube at a constant flow rate of 1cc/sec. A quantitative estimation was made by measuring the length of the colored portion of the column. The range of the determination was 5-300 ppm SO2 when the sample volume was 100 ml and the feeding time was 100 sec., and 1-80 ppm SO2 when the sample volume was 500 ml and feeding time was 500 sec. The mean relative error of the method was below 5%.

5443 APTIC NUMBER 14778

Koerner, Hanns-Joachim
MONITORING OF ATMOSPHERIC SULFUR DIOXIDE EMISSIONS IN THE STATE OF HESSEN. (Ueberwachung der Schwefeldioxid-Immissionen im Lande Hessen). Text in German. Wasser Luft Betrieb, 13(7): 253-255, 1969. 2 refs.

For determination of sulfur dioxide concentration in the atmosphere of Hessen, the silica gel method described in the Association of German Engineers guideline 2451 was used. The method consists of drawing the air sample through a quartz tube prepared with silica gel. In the laboratory, the sample is analyzed by colorimetry with molybdenum blue. To determine the SO2 background concentration in the field, a measurement grid with a side length of 1 km is erected, so that there is one measuring station per sq km. Knowledge of the SO2 background concentration is of particular importance in the vicinity of power plants and industrial plants in deciding whether limit concentrations have been exceeded or not. Since the atmospheric SO2 concentration in the vicinity of such plants is influenced by dispersion conditions, the meteorological situation must also be known. The results of SO2 monitoring in an industrial area of Hessen show that the maximum allowable concentrations were indeed maintained at all times. Apart from these measurements, the atmospheric SO2 concentrations over large cities (Frankfurt, Wiesbaden, Kassel, and Hanau) are also being monitored in Hessen.

5444 APTIC NUMBER 14720

Koestler, D., H. Otto, J. Pittig, and V. Polster
CONTRIBUTION TO CARBOXYHEMOGLOBIN DETERMINATION BY SPECTROPHOTOMETRY. (Beitrag zur spektralphotometrischen Kohlenmonoxid-Haemoglobin-Bestimmung). Text in German. Dent. Gesundheitsw., vol. 22:1740-1743, Sept. 1967. 3 refs.

The spectrophotometric single wavelength method of Fretwurst and Weinecke was used for carboxyhemoglobin determination. Reproducible results were sought and the suitability of the simple, inexpensive, Zeiss 'Spekol' spectrophotometer was tested. First 128 blood samples were analyzed with the universal spectrophotometer, PSM 1 (Zeiss), at 576 nm in order to obtain comparison data for the Spekol. Samples had a carboxyhemoglobin (CO-Hb) content from 0 to 15%. Measurements on the Spekol were taken at a wavelength of 579 nm. Since the CO-Hb determination should also reflect the working place concentration of carbon monoxide, the blood samples were taken before and after work. The change in CO-Hb level of the 68

workers examined was on the average 1.6%. It was surprising that about 85% of all measurements taken by both instruments showed the same trends in the CO-Hb concentration. In the remaining 15% of the measurements, the two units went in opposite directions. The mean deviation of the average measurement of the two units was plus or minus 0.5%. This relatively minor deviation is considered negligible when compared with the advantages of using the much more economic and simpler Spekol.

5445 APTIC NUMBER 13987

Kolyadich, T. N. and S. A. Osina
A METHOD OF COLLECTING SAMPLES OF AEROSOLS FROM AIR DUCTS. (K metodike otbora prob aerozoley iz vozdukhovodov). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, 13(3):48-49, 1969.

Collecting samples of air from ventilation ducts in the course of the electro-emulsion process for metal finishing is difficult, since the two aerosols present as contaminants are oil and soot, which stick to the walls of any filter and are difficult to remove. The authors have developed a special chuck with a conical fitting screwed on it which can be placed in the air stream. A paper filter with a diameter of up to 8 cm folded into the form of a cone is placed on the fitting. When samples are to be collected, the chuck with its fitting is placed directly into the air duct, and the aperture through which the apparatus was introduced is closed off with a vinyl film. The filter is kept to a diameter less than 8% of the diameter of the air duct in order not to interfere with the flow of air in the duct. The conical form of the filter ensures an equal distribution of aerosol over the entire surface of the filter. During the course of the experiments, more than 200 samples of air were collected. It was found that depending on the type of finishing process employed, the quantity of oil and soot aerosols varied between 50 and 130 mg/hr. The data were used to set up a better system of ventilation.

5446 APTIC NUMBER 15231

Furfurst, J.
METHODS FOR THE DETERMINATION AND CONTROL OF THE QUANTITY OF SOLID EMISSIONS. (Zpusoby zjistovani a kontroly mnozstvi tuhych emisi ze zdroju exhalaci). Text in Czech. Ochrana Ovzdusi, 1(7):102-112, 1969. 15 refs.

Air pollution fines in Czechoslovakia are determined according to Law no. 35/1967 on the basis of the amount of polluting substance emitted from the source. The method most commonly used for measuring the amount of pollutant is the gravimetric method. Radiometric and optical measuring devices could be used but are not well known. Determination of the amount of solid emissions can be secured by material balance of the technological process, single measurement of the amount of emission, and continuous measurement of the amount of emission. Many methods are possible, but few are convenient, reliable, and verifiable for daily use. Material balance determination of emission is makeshift; direct measurement is the only reliable method. In the case of large emission sources, it is necessary to continually monitor emissions. Medium size sources call for measurement twice in a five year period and small sources require measurement once every five years.

5447 APTIC NUMBER 15381

Landau, Emanuel and C. Stafford Brandt
THE USE OF SURVEYS TO ESTIMATE AIR POLLUTION DAMAGE TO AGRICULTURE. Preprint, Public Health Service, Cincinnati, Ohio, Div. of Air Pollution, 18p., 1966. (Presented at the Joint Statistical Meetings, Los Angeles, Calif., Aug. 18, 1966.)

Sample surveys and their suitability for furnishing needed data on air pollution damage are discussed. With the present state of knowledge, it is impossible to prepare reliable national estimates of agricultural damage due to selected air pollutants. However, even after national estimates based on sample surveys become available, the relationship between air pollution changes in yield and quality must be determined. Injury to a plant such as spinach may represent damage but the same injury on turnip leaves may represent no damage at all. Further, the injury may result in no economic loss even when there is a loss of nutritional value. Assessing the loss in ornamentals due to minor alterations in appearance or growth imposes an almost insuperable burden on the estimator. The cost of pollution as reflected in damage to agriculture is not known with any reasonable degree of precision and statistically reliable national estimates are unlikely to become available under present methods within the next few years. Instead, a planned program of selected state and regional estimates is necessary. If, as estimated, the agricultural damage attributed to air pollutants is $500 million (1966) a year sample surveys patterned after the air pollution crop survey of the University of California could be particularly rewarding, even though costly. This survey, conducted by trained specialists, reported damage to all major state crops field by field and county by county. Responsible pollutants were categorized. Despite its conservative estimate of damage, the survey is the only reasonably well-documented estimate of loss due to pollution over an extended area. (Author summary modified)

5448 APTIC NUMBER 14777

Landwehr, Martin
PRESENT TRENDS IN DUST SAMPLING AND MAC VALUES IN WEST GERMANY. Can. Mining Met. Bull. (Montreal), 62(690):1052-1060, Oct. 1969.

Dust measuring and sampling instruments and techniques are reviewed. Evaluation methods and efforts to establish uniform tolerance levels are described. Dust samplers are based on different principles. The konimeter is based on the number of particles counted; mining applications are based on routine sampling and the photometric evaluation of samples is used after the preparation of particles above 5 microns by the mining konimeter. In special cases, the Draeger sampler is used for quantitative analysis. General trends are toward larger samples, dust concentration on a weight basis, fractionation into size

grounds by different techniques, and an analysis of composition. Standards or threshold limit values TLV already exist in all industries. Surface industries base their criteria on dust concentrations and quartz contents in particles below 5 microns. The mining industry uses the tyrdalloscope routinely to determine dust concentrations concurrently, the rock content, as determined by ashing samples, is obtained by konimeter. Threshold limits are related to the rock content in respirable fractions and tyndallometrically determined concentrations. The TLVs are based empirically on Landwehr's dust values, as agreed upon with the Mines Inspectorates. Recently, and in accurate sampling, dust samplers have been used that count the dust in two fractions, above and below 5 microns. Mineral composition is determined either for all minerals or dust for quartz. In assessing the dust hazard by Landwehr's dust values, all minerals are taken into consideration. In coal dust sampling, however, only the quartz content is taken into account. Efforts are now being made to coordinate the different assessment methods, arriving at uniform MAC values in agreement with those of other countries. (Author abstract modified)

5449 APTIC NUMBER 15084

Lang, Helen W., W. P. O'Neill, P. A. Coulehan, and P. W. Freedman
CONTINUOUS MONITORING OF DIESEL EXHAUST GAS FOR CARBON DIOXIDE, CARBON MONOXIDE, OXYGEN, METHANE, AND NITROGEN OXIDES. Bureau of Mines, Washington, D. C., RI 7241, 18p., March 1969. 9 refs.
CPSHT: PB 183386

A monitoring system was applied to provide rapid, continuous analyses of diesel exhaust gas. Commercially available continuous analyzers with strip chart readout were employed for nitric oxide, carbon dioxide, methane, carbon monoxide, and oxygen. All five continuous analyzers performed satisfactorily during the preliminary testing and were used successfully during several actual diesel approval tests. The results were checked by two independent analytical methods: gas volumetric and gas chromatographic analyses. It was shown that the use of nondispersive infrared analyzers is a generally accepted technique for on-stream analysis of carbon dioxide, carbon monoxide, and methane gases. Polarographic analyzers worked well for on-stream analysis of oxygen. Mass spectrometry was used to determine the nitric oxide content. Strip chart recorders provided permanent records of all concentration changes during the course of the approval tests. It was believed that the use of analyzers would speed up the diesel approval testing procedure.

5450 APTIC NUMBER 15753

Langmead, W. A. and D. T. O'Connor
THE PERSONAL CENTRIFUGE- A PARTICLE SIZE-SELECTIVE PERSONAL AIR SAMPLER. Ann. Occupational Hyg., 12(4):185-195, Oct. 1969. 15 refs.

A size-selective air sampler, suitable for measuring personal exposure to radioactive dust, was described. Considerations for the design of the sampler were as follows: the procedure should be effective and reproducible; samples should require little or no treatment before a determination is made; the operation should be reliable and simple, requiring the minimum of attention from the wearer; and it should be light, portable, and unobtrusive in the wearer's normal working environment. Sampling at 2 l/min, the sampler separates coarse dust from the finer particles which collect separately on discs of high efficiency glass fiber filter paper suitable for direct radiation counting. Suction is provided by a diaphragm pump, the rapid variation of the air flow-rate being suppressed by a pulsation damper. The collection characteristic of the first stage is such that 50% of the mass associated with the unit density of spherical particles of a diameter about 5 micrometers is collected. The remainder is deposited on a filter paper in the second stage. The fraction of the sampled aerosol deposited on the internal surfaces was measured as a function of particle size. The maximum loss (18%) occurs on the nozzle of the cone for particles about 3 micrometers in diameter. The characteristics of the personal sampler were designed for the measurement of aerosol particles in the approximate aerodynamic diameter range of 1-10 micrometers. The present orifice and nozzle diameters are not suitable for measuring activity median aerodynamic diameter values outside the range of 2-8 micrometers.

5451 APTIC NUMBER 15704

Leahy, T. P.
DETERMINATION OF GASES FROM VISCOSE PREPARATION. Tappi, 52(1): 115-117, Jan. 1969. 3 refs.

A method for the qualitative detection and quantitative estimation of volatile substances evolved during the regeneration of viscose has been developed. The method involves use of conventional methods of analysis as well as the gas chromatograph for the separation of several of the components normally evolved. The methods, as described, have reasonable accuracy and reproducibility based on the use of known standards for calibration. Several series of laboratory prepared viscoses have been studied in an effort to determine the effect of pre- and post-xanthation conditions on the amounts and types of gases evolved during viscose regeneration. An example of a viscose from the crumb stage through ripening is also given. (Author's Abstract)

5452 APTIC NUMBER 15301

Liddell, H. F.
A REAGENT FOR SULPHUR DIOXIDE. Analyst, vol. 80:901, Dec. 1955. 5 refs.

The author describes the discovery of a sensitive reagent for the detection of small quantities of sulfur dioxide in smog to be used on filter paper in conjunction with a suitable pump for sampling. The bleaching effect of sulfur dioxide on dyestuffs was investigated and Astrazone Pink FG (Bayer) was found to be satisfactory as a reagent. A drop of reagent is placed on the filter paper; some of the reagent will spread beyond the hole and furnish a background of unchanged color against which

the bleaching effect may be observed. Air is then drawn through the wet paper at a rate of 250 ml/min until the bleaching takes place and the volume of air required to produce this effect is noted. A concentration of 1.5 micrograms of sulfur dioxide in 500 ml of air will give a definite reaction.

5453 APTIC NUMBER 15297

Little, Arthur D., Inc., Cambridge, Mass.
CHEMICAL IDENTIFICATION OF THE ODOR COMPONENTS IN DIESEL ENGINE EXHAUST. Contracts PH 22-68-20 and CD-13-68, Proj. CAPE-7, Final Report. 92p., July 1969.

As part of an on-going program to determine the relationship between chemical species in diesel exhaust and the intensity and character of the exhaust odor, techniques were developed to isolate and chemically characterize the species responsible for the smoky-burnt portion of total exhaust odor. The system developed: silica liquid column chromatography, followed by silicone and carbowax gas chromatography, and monitoring of the effluent compounds by odor as well as by instruments, demonstrates the variety of odor types and complexity of the chemical mixture of diesel exhaust. These techniques should be sufficient to permit identification, particularly with regard to the lower-boiling temperature fractions, by high resolution mass spectrometry of the materials responsible for the diesel exhaust odor. Once such identifications have been made, studies will be initiated to determine the influence of engine operating parameters and fuel types on the production of these odor species.

5454 APTIC NUMBER 15355

Luis, P., C. V. Carducci, and A. Sa
DETECTION OF FLUORINE ON THE NANOGRAM SCALE; INORGANIC AND ORGANIC FLUORINE COMPOUNDS. Mikrochim. Acta (Vienna), no. 4:870-881, 1969. 6 refs.

Simple techniques are described for detecting fluorine on the nanogram scale. They are based on the evolution of hydrofluoric acid as revealed by an alizarin-3-methylamine-N,N'-diacetic acid-cerium(III) complex reagent and the use of a Pyrex capillary siliconized to prevent the glass from retaining hydrofluoric acid at ordinary temperatures. The methods are suitable for the detection of fluoride in waters, minerals, salts, and organic compounds including complex pharmaceutical preparations and plastics. Even 150 pg of fluorine can be revealed in a 1:500,000 solution of the reagent.

5455 APTIC NUMBER 18778

Maatsch, Jurgen, Horst Achterfeld, and Hartmut Kamphaus
METHOD OF AN APPARATUS FOR THE AUTOMATIC OBSERVATION AND REGENERATION OF DEVICES FOR THE SAMPLING OF WASTE GASES. (Beteiligungs- und Patentverwaltungs G.m.b.H., Essen, Germany) U. S. Pat. 3,457,787. 5 p., July 29, 1969. 6 refs. (Appl. Aug. 2, 1966, 22 claims).

A method is described for sampling dust-containing gas from an oxygen-blowing steel production process where the sampler includes a conduit leading from the process, a filter in the conduit, and analyzers for determining the composition of the sampled gas. The steps in the method comprise feeding a gas sample stream through the conduit; sensing the flow condition of the gas through the conduit; adjusting the feeding of sample gas to maintain a substantially constant rate; observing the state of charge of the filter by detecting variations in the flow conditions; and regenerating the filter by passing pressurized gas through the filter in a reverse direction when the state of charge of the filter exceeds a predetermined value.

5456 APTIC NUMBER 18368

Marshalla, R., G. Crawford, and M. Nolan
CONVERSION FACTORS FOR SOURCE EMISSION MEASUREMENTS OF INCINERATOR FLUE GASES. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 176-179. 2 refs. (May 5-8).

Tighter air pollution codes have created a need for standardized procedures for expressing incinerator dustloading values. Dustloading is usually expressed in pounds of dust per 1000 pounds of flue gas or grains of dust per standard cu ft, where 7000 grains is equal to one pound. In any dustloading test, some of the variables which must be taken into consideration are the type of refuse or fuel being consumed, atmospheric conditions, such as temperature and pressure, and the components of the flue gas. The formulas presented in this paper take these variables into account, and additionally, certain assumptions and simplifications were made to make their derivation possible. A test method is described for measurement of the source emission weight from a specified amount of refuse burned in an incinerator, based on isokinetic sampling. A special slide rule was developed by the authors which greatly simplifies the use of the various formulas presented in the paper. The slide rule may be used to correct dustloading value to either a 50% excess air or 12% CO2 basis. It may also be used for converting grains/cu ft to grains/std cu ft, as well as for converting grains/cu ft to lbs dust/1000 lbs flue gas and vice-versa, and for calculating the percentage of excess air in terms of the Orsat analysis of the flue gas.

5457 APTIC NUMBER 13768

Natalucci, Rudolph F. and Mohamed Abdel-Hady
INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING. J. Sanit. Eng., Div. Am. Soc. Civil Engrs., 94(SA 6):1071-1084, Dec. 1968. 19 refs.

The use of aerial infrared radiation spectroscopy for air and water pollution surveys is discussed. All objects that are above absolute zero emit, absorb, or reflect IR radiation, and identification of the object can be accomplished by the uniqueness of the energy level and the wavelength of the IR

radiation emitted, absorbed, or reflected. The potential application of aerial IR radiation surveys for detecting and tracing the movement of air pollution is promising. In the past, various studies have been conducted which identified specific gases in the atmosphere using atomic absorption spectrophotometry principles. Other studies using IR radiation interference spectrometers have successfully identified plume gases by measuring the emission spectra. Several arrangements for positioning monochromatic and broad band IR radiation sources relative to elevated or airborne detectors have been suggested, including a high altitude balloon and a ground based antenna. There is cognizance of the fact that spectroscopic absorption and emission techniques are not completely developed, but research conducted in the area of IR radiation spectroscopy will place more confidence in the use of this method in pollution surveys. (Author conclusions modified)

5458 APTIC NUMBER 15917

McCarthy, John F.
TRACING PESTICIDE RESIDUES TO PARTS PER BILLION. Pes./Dev., 21(1):18-22, Jan. 1970.

A new gas chromatography system for identifying pesticide residues was developed in conjunction with carbofuran (2,3-dihydro-2, 2-dimethyl-7-benzofuranyl-N-methylcarbamate), a new broad-spectrum insecticide. After the nature of the residue had been determined by applying radioactive tracer techniques to metabolism studies in plants and animals, and extraction techniques developed, an analytical identification method was devised for measuring quantitatively the toxic carbamate compounds present in plant or animal tissues at concentrations as low as 20-50 ppb. The method is based on separation by gas chromatography and detection by pyrolitic reduction of the contained nitrogen to ammonia. It represents the first use of a nitrogen-specific microcoulometric detector for pesticide residue determination. The effluent from the chromatography system enters a pyrolysis furnace, passes to a scrubber furnace, and then to a nitration titration cell where nitrogen content is recorded. The method is applicable to a wide variety of foods and grain.

5459 APTIC NUMBER 15800

EXTENDED TESTING OF THE METHANE IONIZATION DETECTOR. (FINAL REPORT). Contract AT(30-1)-4717, Melpar, Inc., Falls Church, Va. Rept. MVO-4717-1, 21p., Dec. 1968.

A sensitive automatic detector was developed for monitoring the building of methane in coal mines and detecting the gas before it reaches the lower explosive limit. The detector uses a cross-section ionization detector as the basic transducer. Each transducer cell contains two foil electrodes and each electrode contains titanium tritide. A preliminary series of mine tests resulted in improved electronic-circuitry waterproofing, conversion to a single-point ground system to prevent ground loop problems, addition of a heater to prevent condensation of moisture within the detector, and pneumatic balancing of the gas transport system. A reference air system was added to improve the unit's response to small or slow changes in methane concentration. Cross-talk and pickup problems were eliminated when retested and operated continuously for 48 hours, the unit gave no false positive indications of methane concentration. Unfortunately, the probe or the probe line could be damaged by large chunks of falling coal. It is though that this difficulties can be ameliorated by using flexible armored hose instead of stainless steel tubing in the sampling line. The detector has good sensitivity and high selectivity, low noise level and drift rate, and simple maintenance requirements.

5460 APTIC NUMBER 14520

Monkman, J. F.
COMMENTS ON EMISSION DETECTION SYSTEMS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 383-399.

The current state of the art of air pollution detection instrumentation is inadequate with respect to design and construction. Infrared and hydrocarbon analyzers, for example, are inoperable under certain conditions because of electronic noise. Readings of low concentrations are affected by noise at zero position and readings of high concentrations are affected by reading noise. The influence of contaminated fuel on readings may not be recognized. Other analyzers, such as the Hersch cell detector for measuring carbon monoxide, are made of glass and, therefore, are unsuited to outdoor use. Instrumentation is shown to be much better with respect to sensitivity. Sample recorder measurements, as well as practical problems arising in measurement, are illustrated by charts.

5461 APTIC NUMBER 14521

Moses, Harry
MATHEMATICAL URBAN AIR POLLUTION MODELS. Argonne National Lab., Ill. Radiological Physics Div., ANL/RS-RPY-001, 69p., April 1969. 36 refs.

The use of mathematical models for urban air pollution problems is reviewed. Five tables are presented to allow assessment of work in this area. The tables include the location of the study, types of tracers, sizes of the monitoring and meteorological networks, amounts of data collected, and the mathematical equations that were used. The urban air pollution model is considered to have four components. These are the source inventory, which includes point as well as area sources, the network of meteorological stations, the network of pollutant monitoring stations, and the mathematical algorithm which describes the processes which transform the concentrations at the source to those observed at the receptor. Attention is also devoted to verification of the procedures. Two general categories of mathematical models are discussed. The first is the source-oriented model characterized by the work of Turner. In this model, the concentration at a particular point is determined by the superposition of the

contributions from each of the sources upwind. The second is the receptor-oriented model of which there are three types. In the first, the pollutant concentrations at a particular monitoring station are analyzed in a manner similar to that of the source-oriented model. Second is the regression model, in which regression equations are developed relating observed concentrations at a receptor with meteorological variables. Third is the Tabulation Prediction Scheme in which combinations of meteorological variables are arranged in sequence. For each combination, the probability distribution of pollutant concentration is given, along with other statistical parameters such as the interquartile range, the mean, and the standard deviation of the distributions. A summary of verification techniques is given with examples from the work of other investigators. These include scatter diagrams, correlation coefficients, and isopleth comparisons. The weaknesses and strengths of validation techniques are evaluated. (Author abstract modified)

5862 APTIC NUMBER 15163

Nakano, Michio
AIR MONITORING NETWORK IN THE CITY. (Toshi no taikiosen joitanshikimo). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(3):22-28, Oct. 1969.

The recent development of air monitoring systems and the present status of telemetering systems are described. Their monitoring network began in 1960 with an automatic measuring system using the electroconductivity method. Since 1965, sulfur dioxide gas and dust diffusion measurements by the hi-volume sampler have been used at several stations. In 1968, an air monitoring network system adapted with the telemeter system made it possible to obtain realtime data. The increasing need for technical development in air pollution control has made the air monitoring activities in Japan outstanding among those of many countries. The system in Osaka City is now regarded as one of the most well-organized. Air monitoring activities are of two types: one measures SO2 gas as a typical indicator of general air pollution, and the other checks for particular toxic pollutants qualitatively, regardless of quantity. Selection of a site for monitoring stations is determined, as a rule, from population density and structure, pollution type and quantity, and meteorological conditions. Eleven field stations and one central station were established in Osaka and five stations in Sakai City. Data sent to the central station are used in correlation with health studies, in determining air quality standards, and also as one of the basic inputs to the diffusion model.

5863 APTIC NUMBER 15662

Nakano, Michio
AIR MONITORING NETWORKS IN THE CITY, ITS SITUATION AND PROBLEMS (1). (Toshi taiki osen monitoring network, sono genjyo to mondaiten (1)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(4):285-292, 1969.

In order to counteract the air pollution problem, the following information is needed: the state of the emitted pollutant; the propagation system of the dust; its concentration in the contaminated atmosphere; and the effect of the contaminated atmosphere. The selection of the measuring points is discussed with respect to the following methods: the lead peroxide method, where several grid points should be picked at random; the dust jar method, where a decrease in the measuring points is not recommended; and the high volume air sampler, where two points (one in a place of high concentration and another in the suburbs) are adequate. The average error for one year was + or - 2% for multiple point measurements. Several variations of measuring points were discussed for soiling index measurements with respect to accuracy. For the sulfur dioxide measurement, the points should be placed every 8 sq km for + or - 2% accuracy. The monitoring networks in Chicago and New York are illustrated.

5864 APTIC NUMBER 18704

Nemec, L.
CALCULATION OF DIFFUSION OF HARMFUL SUBSTANCES IN THE LOWER ATMOSPHERE. (Vypocet rozptylu skodlivin v prizemni vrstve atmosfery). Text in Czech. Ochrana Ovzdusi, no. 8:53-56, 1969. 1 ref.

Evaluation of potential pollution from new industries is necessary to protect the human environment from the spread of pollutants in the lower atmosphere. Calculations based on the Sutton model of diffusion show that super-elevation of chimney smoke is one of the most important factors to consider in estimating the probable maximum of the lower atmosphere concentration that can be expected for a flat terrain around a given emission source. This factor is influenced by kinetic energy and temperature uplift of emitted combustion products and by the flow velocity of the wind. Chimney height and smoke elevation substantially influence the diffusion of emitted substances in the lower atmosphere. Even under constant conditions of emission and wind, the lower atmosphere maximum concentration changes as the result of variations in turbulent air flow. Variations can be determined by statistical analysis. Objective measurement of background pollution is more difficult in Czechoslovakia. This problem could be alleviated by the construction of a measurement network permitting concentrations of significant pollutants to be monitored in representative places. A methodology is presented for determining the annual level and frequency of emissions from a pollution source. The influence of mountain terrain on sulfur dioxide emissions from thermal plants is also evaluated.

5865 APTIC NUMBER 15207

CURRENT TRENDS IN AIR POLLUTION CONTROL. (Taikiosen taisaku no doko). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 47(493):873-876, May 1969. (1968 printed in error.) 40 refs.

Various studies and experimental methods related to air pollution control are reviewed. In the field of sulfur dioxide treatment,

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a large-scale pilot plant with a capacity of 150,000 N cu m/hr was constructed by a heavy industry company in cooperation with an electric power plant. In addition, a large-scale project of 6000 N cu m/hr using activated carbon is now being constructed. In the hydration method for sulfur removal, Co-Mo-Al2O3 is used as an intermediate catalyst to remove sulfur compounds from Mafoudi heavy oil. Automobile waste gas treatment is a newly important problem, and adequate techniques have not yet been developed. Various experimental studies are divided into two major groups: a study concerned with methods for treating or decreasing automobile exhausts and a fundamental study of automobile exhaust composition. In the field of diffusion problems, a model tunnel method and a tracer method have been developed. Most studies in the field of measurement deal with environmental conditions. Experimental research reported so far includes a para-rosaline method and an analysis of the relationship between the West-Gaeke method, the electroconductivity method, and the formaldehyde colorimetric method.

5866 APTIC NUMBER 15521

Wietruch, Frank and Karl-Ernst Prescher
DILUTION SYSTEM FOR LOW CONCENTRATIONS OF NITROGEN DIOXIDE AND DETERMINATION OF THE SALTZMAN FACTOR. (Dosierung kleiner Stickstoffdioxid-Mengen und Bestimmung des 'Saltzman-Faktors'). Text in German. Z. Anal. Chem., vol. 248:298-302, 1969. 10 refs.

A dynamic flow system is described by which dinitrogen tetroxide (N2O4) is diluted with air in two steps to obtain NO2 concentrations in the ppm range. Through thermostatization of the first stage, the dissociation of the dinitrogen tetroxide could be taken into account during calculation of the NO2 end concentration. With the NO2/air mixture obtained by this method, the Saltzman photometric analysis of NO2, which is based on the formation of an intensely colored azo dye was tested. The results obtained with gaseous NO2 and with equivalent amounts of aqueous nitrite solution are compared. At a concentration of 1.5 micrograms NO2 per 25 ml absorbing solution, the dye formation by 1 mole NO2 equals that of 1 mole of nitrite ('Saltzman-factor' 1.0). If the concentration is 10 micrograms/25 ml, the intensity of the color effect due to 1 mole of NO2 equals 0.86 moles of nitrite ('Saltzman-factor' 0.86). Only half the expected color intensity was found when a NO2/air mixture was used that had been prepared by a dynamic two-step dilution and oxidation of NO ('Saltzman-factor' 0.5).

5867 APTIC NUMBER 15697

Mitsuru, Mideo
SURVEILLANCE OF INDUSTRIAL POLLUTION CONTROL. SPECIAL ISSUE ON SURVEILLANCE. (Kogaihoshi no saheiransu. Tokushu saheiransu). Text in Japanese. Koshu Eisei (Public Health), 33(8):458-458, Aug. 1969.

Survey activities of the Industrial Pollution Observation Center, which was established in Osaka city, are presented in regard to its operational system and construction. The building is arranged as follows: air pollution composite observation room, air pollution automatic measurement room, stack smoke research room, gas and dust research room, heavy oil sulfur research room, chemical analysis room, water quality research room, water quality physicochemical laboratory, and so forth. This observation center has activities directly related to the administrative organization which assumes authorized power over industrial pollution control, and has three functional divisions: constant observation of air pollution status and emergency measurements in the observation division; investigation and research activities on pollutant matter prescribed in laws and regulations in the inspection division; and study and research on pollution control in the research division. Of particular interest in the observation center is the computer system facility. The system was developed because the conventional system had a time lag in the measurement of pollution status and in taping subsequent administrative countermeasures for control. By means of the computer system, prompt and proper actions were made possible. Air pollution numerical values and weather conditions measured at four divisional stations and two observation cars are received by telemeter at the center by radio and are treated by computer. Further use of the computer to attain the composite systematized activity process such as measurements, transmission, treatment, and control is planned.

5868 APTIC NUMBER 15382

Nucciotti, Francesco, Paolo Mandrioli, and Giovanni Sandri
IMPROVEMENTS IN SAMPLING TECHNIQUES AND IN THE METHODS FOR DETERMINING ACID GASES IN THE ATMOSPHERE. (Miglioramenti tecnici nel campionamento e nella metodica per la determinazione di gas acidi nell'atmosfera). Text in Italian. Riv. Ing., no. 5:353-356, May 1969. 11 refs.

Deterioration of pine forests near industrial complexes on the Tyrrhenian and Adriatic seacoasts of Italy led to systematic investigation of air pollution. Chief offenders were found to be the sulfur and nitrogen oxides. To build a sampling network meant developing a practical method, easily reproducible and low in cost. The method of Syozo-Fukui, using a filter soaked in a concentrated K2CO3 solution, seemed best. Analysis of the filter permits determination of SO3, the oxides of nitrogen, and chlorides. Results were good when the relative humidity was below 70%. The filter salt was highly deliquescent, and above 70% humidity significant quantities of test substance escaped. Therefore, a framework equipped with an interchangeable condenser and sheltered by an acrylic plastic casing, the whole being enclosed in a meteorological shelter was provided to hold the filter. For transportation to the laboratory, the filter was sealed hermetically in polyethylene. The method of Fukui was used for nitrogen oxides, but for SO3 that of Johnson-Nishita was preferred; reduction of all sulfur compounds to hydrogen sulfide, measured colorimetrically with methylene blue to a sensitivity of 0.2 ppm. A Schleicher 589 filter was used immersed in K2CO3 solution and dessicated in a vacuum. At the laboratory, nitrogen oxides, sulfur, H2S, and sulfides were determined spectrophotometrically. Agents used for determining nitrogen oxides were sulfanilamide, naphthylethylenediamine, hydrochloric acid, and a standard solution of NO2.

5469 APTIC NUMBER 18358

Okita, Toshiichi
COLLECTION AND ANALYSIS OF ODOROUS GASES. I. COLLECTION OF ORGANIC SULFUR COMPOUNDS BY MEANS OF ORGANIC SOLVENTS AND MERCURIC CYANIDE, AND THEIR GASCHROMATOGRAPHIC ANALYSIS. (Akushu no hoshu bunseki ho no kenkyu I. Yuki ryuki kagobutsu no yuki yobai ovobi shianka dai 2 suigin ni voru hoshu, gasukuromatogurafu ni voru bunseki). Text in Japanese. Koshu Eiseiin Kenkyu Hokoku (Bulletin of the Institute of Public Health), 16(2):59-61, 1967. 2 refs.

Methods of collecting methyl mercaptan, ethyl mercaptan, and dimethyl sulfide, plus gas chromatograph techniques suitable for their analysis were studied. A 4 m column of tricresyl phosphate was effective for the separation of the gases. The flow rate of nitrogen carrier gas was 20 ml/min, and column temperature was 60 C. The minimum measurable weights of methyl mercaptan, ethyl mercaptan, and dimethyl sulfide were 0.24, 0.035, and 0.071 micrograms, respectively. Organic solvents, such as acetone, methanol, ethanol, and ethyl benzene, cooled by a dry ice-acetone mixture, collected gas with a flow rate through the absorber of 1 liter/min. The minimum measurable concentration of methyl mercaptan was 0.15 ppm when 30 liters of air was sampled. A 5% mercuric cyanide solution and glass fiber filter impregnated with mercuric cyanide also effectively collected methyl mercaptan. An active carbon column effectively absorbed methyl mercaptan, but complete desorption of mercaptan from the active carbon was not achieved. (Author abstract modified)

5470 APTIC NUMBER 18496

Okutani, T., S. Shima, I. Harada, M. Kondo, and H. Fukui
SUCCESSIVE MEASUREMENT OF CARBON MONOXIDE IN THE AIR BY CO ANALYZER (TM). (Sekigai sen bunseki sochi ni yoru kichu CO nodo no renzoku sokutei). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):90, April 1969.

Pollution by carbon monoxide present in automobile exhaust gas was determined by non-dispersive infrared spectrometric analysis of air samples from eight intersections and an underground parking lot in Nagoya city. The average concentration of CO at intersections ranged from 8.2 to 8.8 ppm. Because the amount of CO varies according to traffic and weather conditions, measurements must be prudently evaluated. The average concentration of CO in the underground garage varied from 11.2 to 20.4 ppm. Garage attendants are exposed to CO concentrations of 17.4 to 21.0 ppm. Since three hours are required for CO levels to subside following a reduction in the number of automobiles, more adequate ventilation of the garage is proposed.

5471 APTIC NUMBER 18552

Ota, T.
VARIATION OF VERTICAL TEMPERATURE GRADIENT AND CONCENTRATION OF AIR POLLUTANT. (Kion no enchoku bunpu no henka to taiki osen nodo). Text in Japanese. Kishocho Kenkyu Jiho (Journal of Meteorological Research) (Tokyo), 19(8):435-442, Aug. 1967. 3 refs.

The Tokyo Tower was used to observe a vertical temperature gradient and its variation during the day in both summer and winter. Observations were made for one month in each season. The Kawaguchi Tower was also used to confirm the vertical temperature gradient in the lower layer of the ambient air. The temperatures during the day were stable at heights of 80, 120, and 200 meters. The layer of temperature stability was 80 meters in winter and 200 meters in summer. The temperature was more stable on rainy days than on clear days. The temperature was lowest early in the morning, increased during daylight hours, and decreased in the evening. The concentration of suspended dust was highest in the lower air layer (especially at 80 meters), particularly in winter. The concentration of sulfur dioxide showed no significant difference between higher and lower layers because the origin of SO2 emission was distant from these observation towers and therefore the gas was equally dispersed among all layers.

5472 APTIC NUMBER 15551

Penny, M. F. and P. W. Wolff
A MODEL FOR DESCRIBING AIR POLLUTION CONCENTRATION AND POLLUTANT TRANSPORT. Calif. Univ., Richmond, Operations Research Center, 13p., Feb. 1968. 15 refs.

A mathematical model is presented for an unreactive pollutant which relates atmospheric concentrations directly with pollutant emission rates and meteorological variables in the Los Angeles Basin. The model is used to estimate carbon monoxide concentrations over space and time in the basin for selected days; the estimates are compared with observed carbon monoxide levels for the same days. A grid of about one hundred squares (each side 4 miles long) is superimposed on the Los Angeles Basin. Differential equations are used to simulate the transport of pollutants in the basin, one corresponding to each grid square. The following data are required for each square: a pollutant emission rate; a wind vector; initial pollutant concentrations; and a mixing height. The instantaneous mass flow rate of pollutants across boundaries depends only on the wind vectors and the amounts of pollutants within each square. The concentration of a pollutant can be calculated at that location by dividing the amounts present by the mixing height times a conversion factor. Thus, the simulation uses a two-dimensional model to determine how carbon monoxide is distributed over the basin without reference to its actual concentration at any point. Since 90% of all carbon monoxide emission is due to automotive vehicles, the eighty million car-miles per day have to be allocated to the gridwork. Problems in the collection of meteorological information are discussed. A predictive model of this type would be useful in evaluating alternative methods of control, as well as in improving smog forecasting procedures and providing either short or long term warnings of unusually severe situations in time for action to be taken. It is also a necessary first step in the development of a model for reactive pollutants such as the oxides of nitrogen, ozone, and hydrocarbons.

5473 APTIC NUMBER 15150

Peters, Karl-Heinz
THE INFORMATIVE VALUE OF SO2 CONCENTRATIONS COMING FROM CERTAIN DIRECTIONS. (Der Aussagewert richtungsabhaengiger SO2-Konzentrationen). Text in German. Staubreinhaltung (Melzer/Hamburg), 20(10):241-3, 1969. 9 refs.

The atmospheric concentration of SO2 is indicative of the general air pollution situation of a city. The residence time of SO2 after photochemical reaction and catalytic oxidation on atmospheric aerosols is about 4 to 5 days. The wind plays an enormous role in air pollution. On May 20, 1928 an 11-ton phosgene (COCl2) tank became leaky. On the warm, dry day a NE wind blew the phosgene gas cloud over the Hamburg suburbs, Wilhemsburg and Harburg. On that day 300 persons who inhaled the fumes were hospitalized, 10 of whom died. Had the wind come from a southern direction, the density populated areas of Hamburg would have been hit. To prevent such episodes, all emission sources must be located. In this connection, a SO2 wind rose showing the half-hourly average SO2 concentrations as function of the wind direction has great importance. It helps to establish the distance of the emission source. Concentrations measured in the absence of wind indicate the strength of the emission.

5474 APTIC NUMBER 15004

Pfefferkorn, Gerhard and Rochus Klaschke
USE OF THE SCANNING ELECTRON MICROSCOPE FOR ASSESSMENT OF DUST SURFACES. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):8-13, Nov. 1968. 6 refs.
CFSTI: TT 68-50008/11

Illustrated examples show the possibilities and limitations of applying the scanning electron microscope to direct observation of dust surfaces. The scanning electron microscope is simple to use and provides three-dimensional images of particles and their surfaces. It scans the object directly, and the specimen can be rotated and tilted in various positions during observation to permit its most favorable positioning. The considerable magnification range from 20X to 50,000X permits the picking out, from a low-power general view, of the smallest individual particle and its subsequent high-power magnification without costly pinpoint operations. It is shown that small dust particles are generally deposited on larger ones. This advantage is helpful in the field of dust research. It is also helpful that scanning electron microscopy is a nondestructive process. Dust can be investigated on almost any base. Dust can be applied to glass slides or metal foils, either from the atmosphere or from liquids. The method is valuable when used to investigate aerosol spectrograms of dust centrifuges. A disadvantage is that particles thicker than 50nm generally appear as a blurred image.

5475 APTIC NUMBER 15210

Purcell, W. P., W. P. Bennett, and J. T. Allen
A TEST FOR STABILITY OF SOLVENTS TO ULTRAVIOLET RADIATION. Am. Chem. Soc., Div. Org. Coatings Plastics Chem., Preprints, 29(2): 441-444, 1969. (Presented at the Am. Chem. Soc., 158th Meeting, New York, Sept. 1969.)

A simple screening test was devised to determine the stability of solvent vapors to ultraviolet radiation in the presence of NO2. Stability is measured by following the disappearance of the solvent as shown by gas chromatograms taken at various time intervals. Multiple runs were made on most of the solvents and excellent reproducibility was obtained. The test results indicated considerable variation in the stability of various solvents under these static conditions. The test is a simple and inexpensive method for measuring solvent stability to ultraviolet radiation. If an equally simple test for eye irritants can be found utilizing irradiated samples from this method, a useful test for screening smog-producing potential will be possible.

5476 APTIC NUMBER 15281

Baaen, Helen B.
POLAROGRAPHY OF SULFUR DIOXIDE (SOLUTE) IN AQUEOUS HYDROFLUORIC ACID. Anal. Chim. Acta, 44(1):205-210, 1969. 25 refs.

The polarographic wave for sulfite in aqueous hydrofluoric acid was studied. A well-formed wave exists at a half-wave potential of about -0.8V relative to a saturated calomel electrode. The characteristics of the wave are similar to those of the wave for sulfite in aqueous solutions of hydrochloric acid and of nitric acid. The relation of the sulfite concentration to the diffusion current is linear, and the wave is reproducible. Polarography in aqueous hydrofluoric acid media was indicated to be a suitable method for the detection and direct determination of sulfur dioxide. Possible significant applications of the method are to determine contaminative sulfur dioxide in hydrogen fluoride gas, in reagent grade hydrofluoric and fluorosulfuric acid, and in the atmosphere. (Author summary modified)

5477 APTIC NUMBER 14606

Beckner, Louis B.
DIESEL ODOR MEASUREMENT. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 199-208.

A procedure for measuring the intensity of diesel exhaust odor using human panelists was developed and evaluated. Requirements in developing the odor panel techniques were an exhaust dilution and panel exposure system, a method of selecting and training panelists, a set of diesel odor intensity standards, and the design of the test program. The dilution and panel exposure consisted of a face box and exhaust diluted with air at the

engine exhaust pipe reaching the sniff box in 4 sec and a residence time of 15 sec. Panelists were selected by testing the olfactory ability of a large number of candidates. Twelve bottle standards were used in which odorants were dissolved in mineral oil and each successive bottle had twice the concentration as that in the previous one. Panelists were trained using peppermint and cinnamon to identify the twelve bottle standards by number and to rate diluted exhaust in a sniff box. When this was done satisfactorily, test programs were run. Test programs were designed to facilitate statistical analysis. Three engine operating conditions and four exhaust dilutions were used. Each test condition was presented once in each of the four sessions. Results showed that this procedure can be used to draw statistically valid conclusions concerning the effect of parameters such as engine types, operating conditions, and fuels upon diesel exhaust odor intensity.

5478 APTIC NUMBER 15223

Regenberg, E. and P. Wahl
A NEW METHOD FOR PHOTOMETRIC EVALUATION OF KONIMETER DUST MEASUREMENTS. (Eine neue Methode zur photometrischen Auswertung von Konimeter-Staubmessungen). Text in German. Z. Ges. Hyg. (Berlin), 15(9):649-651, Sept. 1969. 5 refs.

A photometric method is reported for more rapid and precise evaluation of konimeter dust samples. Two photo-elements are switched in such a way that the influence of the object disk and the dust adhesive are eliminated. The method is based on the absorption of light by the dust particles and the adhesive. Two photo-cells are used: one measures light received after passage through the dust, while the other measures light passed through an empty spot on the disk. The difference in current between the two cells is measured. At a dust particle concentration of 100/cc, there is a possible error of + or - 4%; at higher concentrations, the error decreases.

5479 APTIC NUMBER 14831

Regener, Victor H. and Luis Aldaz
SOURCES OF ATMOSPHERIC OZONE. New Mexico Univ., Albuquerque, Dept. of Physics and Astronomy, Contract AF 19(628)-5938, Proj. 8631, Task 863102, Work Unit 86310201, AFCRL-69-0138, 171p., March 15, 1969. 22 refs.
AD 689,813

This report contains three papers on studies of atmospheric ozone. In 'Turbulent Transport Near the Ground as Determined from Measurements of the Ozone Flux and the Ozone Gradient', simultaneous measurements of the vertical fluxes of ozone and heat were made, together with measurements of the vertical profiles of ozone and temperature in the first 16 m above the surface. The eddy flux of ozone was determined by a new method using the decay of ozone in a box with open bottom, placed on the ground. The results showed that measurements of the ozone flux and ozone gradient can be used for determinations of the eddy transport of atmospheric properties in low-wind situations, whenever measurements of temperature or wind profiles and of the related fluxes are not practical. In 'Flux Measurements of Atmospheric Ozone Over Land and Water', it was determined that the downward flux of ozone over New Mexico soil averages 3 times 10 to the 11th power molecules/sq cm-sec, and over the Atlantic Ocean 0.2 times 10 to the 11th power molecules/sq cm-sec. Estimates for the global ozone sink range from 5.4-8.6 times 10 to the 29th power ozone molecules/sec. In 'Folded Optical Path of Great Length From Multiple Reflections Between Two Corner Cube Reflectors', the design of a simple multiple-path absorption chamber is presented, in which the light path travels back and forth between two corner cube reflectors. As a result of the exact beam reversal, which is automatically provided by these reflectors, precise optical alignment is unnecessary. Selection of a desired number of transversals is accomplished by means of suitably placed aperture stops. The light paths do not cross over each other anywhere. The report also contains 205 computer-plotted graphs showing profiles of ozone, temperature, and wind in the first 16 m above the surface. (Author abstract modified)

5480 APTIC NUMBER 14808

Rhine, P. P., T. D. Tubbs, and Dudley Williams
NITRIC ACID VAPOR ABOVE 19 KM IN THE EARTH'S ATMOSPHERE. Appl. Opt., 8(7):1500-1501, July 1969. 6 refs.

Atmospheric data obtained from balloon flights by other investigators suggested that previously unreported atmospheric bands at approximately 30 km and a solar zenith angle of 90 deg were caused by the association of nitric acid vapor with the ozone layer. To estimate the amount of nitric acid vapor in the atmosphere at this altitude, atmospheric nitric acid vapor was experimentally measured in an absorption cell in the spectral regions of 1240-1380 inverse cm and 810-940 inverse cm. Laboratory and atmospheric data were compared by integrated spectral absorbance. Approximately 10% of the total absorbance in both laboratory and atmospheric spectra is associated with Q branches at the overlapping bands 879 and 897 inverse cm, and it is concluded that any observable nitric acid vapor contributions to solar absorption spectra at low altitudes would be connected with these band Q branches. Production of nitric acid vapor in the ozone layer may proceed according to the reactions H plus O3 yields O2 plus OH*, or OH plus NO2 yields HNO3. The second reaction is presumed to be enhanced by darkness.

5481 APTIC NUMBER 15722

Rohin, M. A. and V. N. Spektorskii
METHOD OF DETERMINING SOOT CONTENT IN HOT GAS FLOWS (EXCHANGE OF EXPERIENCE). Ind. Lab. (USSR) (English translation from Russian of: Zavodsk. Lab.), 35(2):248-249, Feb. 1969.

An apparatus for determining high concentrations of soot in hot gases is described. Gas from a sampling tube is passed to a deposition surface cooled by a water jacket. The reaction mixture condenses on the cold surface, washing the soot into a receiver

connected by hoses to a cloth filter. The frame supporting the filter is heated by gases purified in the filter, and serves as a heat screen. Before passing through a flow meter, the gas is cooled and dried at ambient temperatures. Gas is drawn through the system at controlled volumes by vacuum suction. Tests with cotton cloth filters showed that 100% of soot is trapped. Determinations are sufficiently accurate for measurements on hot gas flows with soot concentrations greater than or equal to 5 to 50 g/cu m.

5882 APTIC NUMBER 14916

Rodgers, S. J., R. J. Adamcak, and J. W. Mausteller
DEVELOPMENT OF MEDIUM FLOWRATE, HIGH PURITY PARTICULATE AND IODINE FILTERS. Oak Ridge National Labs, Tenn. Intern. Symp. Fission Prod. Release Transport Under Accident Conditions, Oak Ridge, Tenn., April 1965, vol. 2:1204-1215. 1 ref.

Field tests in the area of fission product release, as well as studies associated with nuclear-powered aircraft and rockets, prompted a development program for high purity particulate and iodine air-sampling filters. This paper describes the program, the characteristics of the filters, and laboratory techniques for handling the filters after sampling. Air sampling filters with medium flow rate, high purity, high efficiency for particles 0.07 microns in diameter, high efficiency for iodine filtration, and completely dissolvable was designed. For the particulate filter, a number of different paper and synthetic fibers were evaluated with respect to purity, filtration efficiency, and dissolution characteristics. Two of the more promising fibers were Fortisan, a reconstituted cellulose, and microfibers, a synthetic acetate material. Efficiency of these filters was greater than 90% for particles 0.07 microns in diameter. The efficiency of carbon fibers for iodine filtration was evaluated. These fibers are made by carbonizing synthetic fibers and activating carbonized fibers. Fiber size is controlled by selection of the raw material, and the degree of carbonization and activation are subject to the various parameters of the manufacturing process. High purity is attained by control of the starting material. Filter mats made from carbon fibers were 99.5% efficient in removing iodine at flow rates of 30-35 cfm. A composite filter was made from Fortisan and a carbon fiber mat for sampling debris from various nuclear reactor tests. Efficiency is high for both particulates and iodine. The three types of filters are adaptable to most air sampling problems. The carbon filter can be used for air purification applications and for respiratory protection with respect to fission-gas removal from the atmosphere.

5883 APTIC NUMBER 15738

Roebisch, Gerhard
THE PHOTOMETRIC DETERMINATION OF TRACES OF LEAD BY TREATMENT WITH 7-(ALPHA-(O-CARBOMETHOXYANILINO)BENZYL)-8-HYDROXYQUINOLIN. (Die Photometrische Bestimmung von Bleispuren unter Verwendung von 7-(alpha-(o-Carbomethoxyanilino)benzyl)-8-hydroxychinolin). Text in German. Anal. Chim. Acta, 37(3):539-546, 1966. 18 refs.

Traces of lead were extracted and spectrophotometrically determined by treatment with 7-(alpha-(o-carbomethoxyanilino)benzyl)-8-hydroxyquinolin. The molar absorptivity was 8500 at 410 nm. The determination is highly selective in the presence of suitable masking agents. The influence of Al, Bi, Ca, Cd, Co, Cu, Fe, In, Mg, Mn, Ni, Tl, and Zn was examined. Bismuth was co-extracted by the reagent. It was concluded that lead can be determined by a modified, less sensitive procedure. (Author summary modified)

5884 APTIC NUMBER 15533

Romanek, Walter, Mary B. Jackson, and Alvin Lieberman
PROTOTYPE FLY ASH MONITOR FOR INCINERATOR STACKS. (Final Report). IIT Research Inst., Chicago, Ill., Technology Center, R-IITRI-C8088-8, 145p., Sept. 25, 1968.
CFSTI: PB 183393

A prototype monitor for particulate emissions from municipal incinerators was designed, built, and field tested. In operation, the instrument is installed on a stack some distance above the base to ensure the monitor's presence in a laminar flow region. The monitor samples a predetermined quantity of stack gas either isokinetically or at a known velocity, separates the particulate from the gas by means of a cyclone, and measures the amount of particulate collecting using a beta gauge. For each sample, the time of sampling and beta attenuation is printed out on a paper tape at a convenient ground level location. The design concept is suitable for unattended monitoring operations. Field tests show that the instrument measures stack dust loading under varying furnace operating and atmospheric conditions and that automatic isokinetic sampling, while feasible, is not an essential requirement for adequately following stack loading. (Author abstract modified)

5885 APTIC NUMBER 15556

Rueger, Gert, Bad Klosterlausitz, Elenor Waivald, and Christian Feddersen
A CENTRIFUGAL SEPARATOR AND ITS PROPERTIES. Staub (English Translation from German of: Staub, Reinhaltung Luft), 28(12):9-15, Dec. 1968. 9 refs.

A centrifuge was developed which facilitates the determination of the size distribution of aerosols up to about 0.1 micron in diameter. The aerosol is introduced into a rotating separation channel in such a manner that laminar flow conditions are guaranteed on the basis of the channel dimensions and the selected flow velocities. The separation channel has the form of a planar logarithmic spiral. At the entrance of the channel all particle sizes are statistically distributed over the cross section and are subject to a position-dependent centrifugal field. The outer wall of the channel is furnished with a suitably treated strip on which the particles are deposited. It was established that the deviations of the aerosol spectra obtained with the centrifugal separator from those obtained with the thermal precipitator and the electron microscope

can be attributed to the fact that the flow conditions in the separator channel are much more complicated than those which had to be assumed for the calculations of the separation path lengths. While the disturbances due to inflow conditions could be reduced by introducing certain structural changes, it seems hardly possible to eliminate the disturbances caused by axial eddies. The behavior for other rotational speeds could not be investigated for reasons of design. A careful calibration with monodisperse aerosols would have to be carried out for each particle density, since the disturbance effects are undoubtedly mass-dependent. This could only provide partial improvement, since not only the wrong separation path lengths but also the nonuniform deposit play a large role in distorting the results. In the case of aerosols with nonspherical particles, the relationships become more complicated and the comparison possibilities more unfavorable.

5986 APTIC NUMBER 18790

Ruppracht, W. P. and T. P. Phillips
THE UTILISATION OF PURI-PICK WICKS AS SULPHUR DETECTORS. Anal. Chim. Acta, 47(3):439-449, 1969. 15 refs. (Presented at the International Symposium on Analytical Chemistry, Birmingham, England, 1969.)

Preliminary experiments showed that continuous introduction of hydrocarbons into a flame did not produce a satisfactory emission and that it could only be successfully used when attached to a chromatograph. A double burner was devised which allows continuous measurements to be made. Applications of the burner and the gas chromatographic detector were determined. The flame emission detector used in gas chromatography requires considerable care for quantitative use. Calibration is difficult and is unsatisfactory over some concentration ranges. It is of use in the 0.1-100 ppm range if suitable calibrations are made. For the continuous measurement of total sulfur, the combined oxygen burner and detector are more suitable. The concentration of SO2 in the combustion products of gas burners was determined at as low a level as 0.08 ppm in a 10 ml sample of gas with the same column. Odorants in process gas and natural gas were detectable at 0.05 ppm with a temperature-programmed column. The total sulfur burner was calibrated for liquid samples with solutions of thiophene in desulfurized light distillate giving a concentration range of 20-300 ppm sulfur. At levels lower than 20 ppm, the signal to noise ratio was excessive, arising from fluctuations in the rate of delivery of the hydrocarbon from the micropump. This difficulty was not experienced with gases, and lower levels were detected. For gases, the instrument was calibrated by the addition of H2S to hydrocarbon gases with mixtures prepared in the range of 0.1-10 ppm sulfur. The sulfur content was checked independently by the methylene blue method. The burner was successfully used in the on-stream monitoring of hydrocarbon gases to determine odorant content of the gas in the range of 0.1-10 ppm. With this method of measurement, many of the difficulties inherent in chromatographic determinations of sulfur compounds are avoided.

5987 APTIC NUMBER 15228

Sanderson, J. G. and R. J. Roy
MEASUREMENTS AND SAMPLING OF AIR POLLUTANTS FROM A KRAFT MILL. Pulp Paper Mag. Can. (Quebec), 70(21):85-90, Tech. Paper 7808, Nov. 7, 1969. 12 refs. (Presented at the 55th Annual Meeting of the Technical Section, Canadian Pulp and Paper Assoc., Montreal, Que., Jan. 28-31, 1969.)

Grab and continuous sampling methods for measuring emissions of particulate and gaseous pollutants from kraft mills are reviewed. In the grab method of particulate sampling, a sample of gas containing the entrained particulates is withdrawn through a probe inserted in the gas duct; the same gas velocity as in the duct must be maintained through the probe (isokinetic sampling). A sampling train assembly for unsaturated gas streams and the preferred types of filters are described. Sampling of saturated gas streams is much more difficult but less imperative for pollution control. Continuous methods of particulate sampling include use of a holometer, which continuously measures the fraction of light that has penetrated or has been absorbed by a path of stack gas at a given distance from a light source of constant intensity, and continuous salt cake monitors. Both methods, in their present development, are considered best used as control instruments and as tools for showing visual indication of upset conditions in an electrostatic precipitator. Correlation to date with grain readings has not been sufficiently good to obviate the need to sample the stack. In gas sampling, bench gas chromatographs with flame ionization and thermal conductivity detection methods are probably the most reliable and versatile means of measuring the concentration of reduced sulfur gases from grab samples taken at the emission sources. In-line gas chromatographs, the Murray sulfimeter, and the Barton titrator are described as methods of continuous gas sampling. It is concluded that the fairly recent introduction of continuous methods of sampling and measurement of particulates and gases emitted from the recovery furnace will provide valuable information for combating pollution from this source, and, when fully developed, will overcome many of the problems inherent in grab sampling methods.

5988 APTIC NUMBER 18985

Sano, T.
PARTICULATE LEAD IN AUTOMOBILE EXHAUST GASES. (Jidosha haikigasu chuno horoidodo nawari kahobutsu). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(2):6-8, June 1969. 11 refs.

Aerosols of lead-containing particles from automobile exhaust found in urban atmospheres were measured, with particular emphasis on their weight concentration and particle size. Automobiles were mounted on a dynamometer, and particles in the exhaust gas were collected by a Cottrell precipitator. Tests in the U. S. and Japan showed that the weight concentration of lead per cubic meter of air in cities was in the range of a few tenths of a microgram to several milligrams. The concentration was in the range where a deleterious effect upon human health might be found. An aerosol spectrometer and millipore filter were jointly used to analyze the urban air, where the particle size was found to be much smaller than 1 micron in diameter and

the aerosols were considerably stable. For the purpose of establishing an ambient air quality criterion with respect to lead, Kehoe's study on humans and Huester's experiment on animals were considered. It is concluded that a method for detecting a lead-containing particle in an atmospheric aerosol and measuring its size is technically difficult, but that the development of such a method is imperative.

5489 APTIC NUMBER 14413

Sawicki, E.
FLUORESCENCE ANALYSIS IN AIR POLLUTION RESEARCH. Talanta, 16(9):1231-1266, Sept. 1969. 120 refs.

Luminescence phenomena are of value in the analysis of air pollutants. The problems arising in the use of excitation and emission spectra under various conditions are discussed. Phenomena such as solvent, pH, and photochemical effects are shown to play an important role in the fluorimetric analysis of air pollutants. Many of the fluorimetric methods used in the trace analysis of organic airborne particulates involve factors such as direct measurement of the separated pollutant on a chromatogram or pherogram, quenching phenomena, scanning, excimer formation, charge-transfer fluorescence, sensitized fluorescence, and photooxidation on adsorbent or in solution. In addition, fluorescence assay methods are discussed in terms of selectivity, speed, simplicity, accuracy, precision, interferences, and the relation between concentration and fluorescence intensity. (Author summary)

5490 APTIC NUMBER 15552

Sawicki, E., T. W. Winfield, and C. R. Sawicki
SOLVENT EFFECTS IN PHOTOMETRIC ANALYSIS. Cincinnati, Ohio, National Air Pollution Control Administration, 116p., 1969(?). 205 refs.

Solvents used to dissolve samples play an important role in photometric analytical methodology through ultraviolet absorptiometric, colorimetric, fluorimetric, low-temperature fluorimetric, and phosphorimetric methods of measurement. Stress is placed on solvent-effected changes (occurring in the position and intensity of the long-wavelength maxima of chromogens, fluorogens, and phosphorogens) of definite or potential use in organic trace analysis of environmental pollutants. Attempts were made to correlate the following macroscopic properties of solvents with their spectral effects: dielectric constant, dipole moment, and refractive index. Other important factors that affect the spectra include hydrogen bonding, solvent-solute dipole interaction, and solvent-solute polarizability interaction. The application of photometric analytical methodology to air pollution analysis is discussed. (Author abstract modified)

5491 APTIC NUMBER 15333

Sayer, William J., Dudley R. Shean, and Jamshid Ghosseiri
ESTIMATION OF AIRBORNE FUNGAL FLORA BY THE ANDERSEN SAMPLER VERSUS THE GRAVITY SETTLING CULTURE PLATE. I. ISOLATION FREQUENCY AND NUMBERS OF COLONIES. J. Allergy, 44(4):214-227, Oct. 1969. 12 refs.

The gravity settling culture (GSC) plate and the sequential impaction cascade sieve volumetric air (SICSVA) sampler devised by Andersen were critically compared in the estimation of airborne fungal flora. One hundred twenty-seven side-by-side simultaneous 15 min samples were obtained on Mehrlich's medium in Northern California. The SICSVA sampler collected 25 fungal types totaling 14,300 colonies, and the adjacent GSC plates displayed 18 genera in 1091 colonies. Statistically significant differences in total colonies and frequency of isolation were noted for Penicillium, Alternaria, Aspergillus, Gliocladium, Pullularia, Rhizopus, Saccharomyces, Stemphilium, Ustilago zeae, and other unidentified fungi. The capability of the SICSVA sampler to volumetrically isolate in a reproducible fashion numbers of airborne fungal spores was demonstrated. It was suggested that these colonies can be logically grouped into a fraction that generally would lodge in the upper respiratory tract and another fraction which, because of the small spore sizes, would largely be capable of lung penetrance. Both methods demonstrated a capacity to produce falsely negative data, but this was especially true for the GSC plate. The GSC plate method cannot be endorsed for the quantitative evaluation of airborne fungal spores. (Author abstract modified)

5492 APTIC NUMBER 15427

Schneider, Werner
APPLICATION OF GAS CHROMATOGRAPHY TO SPECIAL PROBLEMS OF FLUE GAS ANALYSIS. (Anwendung der Gaschromatographie auf spezielle Probleme der Rauchgasanalyse). Text in German. Wiss. Z. Tech. Univ. Dresden, 12(4):871-76, 1963. 52 refs.

Principles of gas adsorption chromatography and gas distribution chromatography are reviewed. The first method is primarily used for separating and determining gases such as nitrogen, hydrogen, oxygen, CO, CO2, and methane, as well as noble gases. The second method is used for analyzing organic substances, particularly saturated and unsaturated hydrocarbons. A schematic illustration of a gas chromatograph is given. Hydrogen, nitrogen, oxygen, and carbon monoxide in flue gas can be determined simultaneously by gas chromatographic analysis, but other gases must be determined separately. Adsorption chromatography on molecular sieves at room temperature is recommended for separating N2, O2, and CO. Carbon dioxide is best determined by adsorption chromatography with activated coal or silica gel at 20 C. Sulfur trioxide cannot be separated by this method because high temperatures are required to prevent its condensation. Sulfur dioxide is irreversibly adsorbed by the molecular sieve 5A and activated coal. Tests with Sterchamol, a silicon-containing support substance impregnated with silicon oil, show, however, that SO2 can be satisfactorily separated. Through proper calibration, SO2 concentrations of 0.4% (by volume) are determined with an accuracy of + or - 0.005% by volume. The detection threshold is about 300 mg SO2/cu m.

5493 APTIC NUMBER 15339

Schreiber, Erich and Othmar Skatsche
DEVICE FOR DETERMINING THE SOOT CONTENT OF FLUE GASES. (Hans List, Graz, Austria.) U. S. Pat. 3,468,257. 3p., Sept. 2, 1969. 2 refs. (Appl. Feb. 18, 1967, 3 claims).

A system for determining the soot content of flue gases comprises a sampling pipe branching off the pipe carrying the flue gas current, a filter tape capable of rhythmic motion in transverse relation to the sampling pipe, and a step-by-step switchgear for the rhythmic advance of the tape. The degree of blackening at certain sections of the filter is measured by a photoelectric measuring instrument. Continuous surveillance of the soot content of flue gases is possible without interrupting the operation of the machine to be tested. If desired, samples can be taken at short intervals during the operation of the machine, and recordings can be evaluated directly at the test bench. The blackened filter tape can be evaluated at another place or at a later date.

5494 APTIC NUMBER 14992

Shaw, John H., Dale Ford, Donald Snider, and Robert Mitchell
RESEARCH DIRECTED TOWARD DETERMINATION OF RADIOACTIVE PROPERTIES AND COMPOSITION OF THE ATMOSPHERE. (Final Report.). Ohio State Univ. Research Foundation, Columbus, Contract F19628-67-C0216, Proj. 7670-03-01, Task 767003, AFCRL-69-0062, 70p., Dec. 16, 1968. 13 refs.
AD 685097

Progress in the construction of a Fabry-Perot interferometer to use in increasing the resolving power of the 2.0 m Ebert-type spectrometer in the region of 4 to 6 microns is described, including the optical alignment procedures used and the control system design. A 21-m long, 76-cm diameter stainless steel multiple traversal absorption cell was constructed and its performance is described. Preliminary measurements of the abundance of ground level CO in laboratory air were made by using the line P of the fundamental vibration band; they indicate that this method of air sampling is accurate, unambiguous, and rapid. Two related papers are included as appendices: one presents measurements of the strengths of the N2O bands near 4.5 microns; the other discusses the infrared spectrum of ozone. (Author abstract modified)

5495 APTIC NUMBER 14429

Shaw, Manny
ELECTROCHEMICAL TRANSDUCERS FOR AIR POLLUTION MONITORING. Preprint, Am. Chem. Soc., Pittsburgh, Pa., Div. Water, Air, Waste Chem., 8p., 1969. (Presented at the Am. Chem. Soc., 158th Natl. Meet., Div. Water, Air, Waste Chem., New York, 1969.)

Electrochemical transducers that permit the monitoring of SO2, NO, and NO2 in the presence of hydrocarbons, CO, CO2, ozone, oxygen, nitrogen, and water are described. By the proper selection of electrolyte, membrane, sensing electrode catalyst, counterelectrode, or potentiostatic control, electrochemical sensors can be made selective to SO2 in the presence of NOx and vice versa, as well as selective to NO2 in the presence of SO2 or NO. Full-scale sensitivities range from 0 to 2, or 0 to 1000 or 5000 ppm. Minimum detectability at present is 0.08 ppm. Response times of 10 seconds to 90% of steady-state value have been obtained. Present sensors are compensated to permit operation with samples varying from 40-100 F. The technology of the electrochemical transducer is described. It is a sealed unit, easily integrated as a component part of the monitor, the remaining components being electronic in nature. Operation of the monitor is simple, involving adjustment of only three control knobs. The use of the electrochemical transducer-type of monitor for the continuous analysis of nitrogen oxides in vehicle exhaust emissions is briefly noted, as well as its possible application for monitoring SO2 in certain industrial emissions. (Author introduction modified)

5496 APTIC NUMBER 18551

Shaw, Manny
ELECTROCHEMICAL TRANSDUCERS FOR AIR POLLUTION MONITOR. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 401-410.

Recent developments at Whittaker Corp. relating to the design and performance of electrochemical transducers for the continuous monitoring of pollutant gases are discussed. These are devices operating on the principle of electrooxidation or electroreduction of adsorbed pollutant species at a sensing electrode, resulting in the generation of a current directly proportional to the partial pressure of the gas in the mixture under analysis. Such a transducer is a sealed, maintenance-free sensor, and is essentially an adjunct to the electronic packaging comprising the total monitor. A series of diagrams is presented; these show (1) some typical half-cell reactions representing the electrooxidation of SO2 and NO; (2) a schematic diagram of the sensor; (3) the mathematical expression of the diffusion current generated in the reaction; (4) and (5) linear responses for various concentrations of NO and SO2; (6) a photograph of a vehicle emission monitor now on the market; and (7) a portion of a typical 7-mode cycle vehicle emission test that demonstrates that the electrochemical transducer can faithfully reproduce each peak and valley of nitrogen oxide concentration as it varies with the acceleration and deceleration mode.

5497 APTIC NUMBER 14883

Sieh, Rudolf Hans Walter
NEW MEASURING METHOD TO DETERMINE THE SURFACE AREA, PORE VOLUME AND PORE RADII OF FINELY PARTICULATE SUBSTANCES. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11): 61-66, Nov. 1968. 11 refs.
CFSTI:TT 68-50488/11

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A simplified, rapid measurement technique for recording complete adsorption-and desorption-isotherms is described. From these determinations of the surface area, pore volumes and pore size-distribution curves (of fine particulates) were estimated. The apparatus is based on the volumetric principle, while nitrogen is used as adsorbate gas at 78 K. The dead space of the sample bulb is completely compensated by a twin arrangement of gas-burettes, manometers, sample-and blanc-bulbs. By calibrating the blank part of the twin arrangement the measurement technique and the evaluation of the data is rationalized considerably. The specific surface of a large number of different substances was determined. The measuring range extended from 0.5 sq m/g up to 400 sq m/g. The results were reproducible within 2%. The required substance quantity depends upon the size of the surface. It is approximately 2.5 g for surfaces of 1 sq m/g, 10-20 sq for surfaces of 400 sq m/g. The time for the actual measuring sequence, not including the evacuation period, is about 20 min, including evaluation (6 measuring points). This apparatus is also suitable for the rapid determination of the density of solids with helium.

5498 APTIC NUMBER 15901

Simecek, Jaroslav and Pero Siltanen
CONTRIBUTION TO THE DETERMINATION OF THE TOTAL CONCENTRATION AND TRAP OF DUST PARTICLES. (Beitrag zur Bestimmung der Gesamt- und Feinstaubkonzentration). Text in German. Staub, Reinhaltung Luft, 29(11):460-464, Nov. 1969. 9 refs.

During investigations of dust conditions in Finnish foundry works, measurements obtained for total gas concentration were comparable for the five methods used. The methods used were a high volume sampler, an electrostatic precipitator, a membrane filter, a Czechoslovakian two-step dust measuring apparatus, and a portable monitoring pump. Practical experience with the impinger method was unsatisfactory. It was emphasized that it is necessary to standardize the sampling method and the separation of the fine dust fraction. Dust particles below 5 micron are not satisfactorily measured with the methods tested. The disparity between the results was excessive. (Author summary modified)

5499 APTIC NUMBER 16607

Shala, W., P. G. Padrta, and D. C. Samson
DIESEL EXHAUST POLLUTANTS. PART I. IDENTIFICATION. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 209-220.

High molecular weight organic constituents of diesel exhaust other than unburned diesel fuel were identified. Samples were collected by the use of a thermal gradient trap from a slip stream off the total exhaust effluent. The organic pollutants were partitioned out with n-hexane. A portion of the diesel odor concentrate was subjected to additional separation over silica gel. Identification of the components was made by mass spectrometry. The pollutants were found to be partially oxidized components of the diesel fuel over its full molecular weight range. Five different classes of oxygenated hydrocarbons were found: aldehydes and ketones, carboxylic acids, alcohols, phenols, and nitrophenols. These yielded a total of over 400 observable species. Aldehydes and ketone derivatives of paraffins, cycloparaffins, olefins, and aromatics were observed. In the aromatic series, benzaldehyde, indanone, cinnamaldehyde, indenone, naphthaldehyde, acenaphthenone, and fluorenone and their higher homologues were found. The aromatic carbonyl compounds were the predominant species. The vital role of the aromatic oxygenates in the diesel odor picture was further substantiated by the absence of diesel odor in the exhaust when a fuel consisting of only n-paraffins was used. The precursors of diesel odor are therefore considered to be primarily the aromatics present in diesel fuel. Their observed relative enrichment is reasonable when one considers the relative rates for oxidation of a paraffin versus an aromatic. For aromatics, oxidation to intermediate compounds is faster than for paraffins, and complete oxidation is slower.

5500 APTIC NUMBER 18705

Spurny, K.
PHYSICS AND CHEMISTRY OF ATMOSPHERIC EMISSIONS AND IMISSIONS. (Fyzika a chemie atmosferickych emisi a imisi). Text in Czech. Ochrana Ovzdusi, no. 2:22-25, 1969. 16 refs.

This review of the physics and chemistry of air pollution attempts to define important branches in the field of atmospheric conservation, e.g., aerosol physics and chemistry, photochemistry of air pollution, and chemical analysis of air pollutants. Problems relating to applied physics and chemistry are discussed, and important methods of evaluating air pollution problems are summarized. In the field of physics, the importance of atmospheric dispersion models for the study of atmospheric aerosols is stressed. In the chemistry of air pollution, particular attention is given to analytical and measurement methods for studying the chemical reaction of pollutants and smog formation. (Author abstract modified)

5501 APTIC NUMBER 15925

SMOKE PLUMES FROM TALL STACKS. Stanford Res. Inst. J., no. 27:13-18, Dec. 1969.

The use of lidar to define plumes from tall stacks was discussed. An intense, narrow-beam, extremely brief pulse of light from a laser is fired into the atmosphere and is reflected to the lidar by particles of material in the path. The density and distance of particulate matter can then be determined from the character of the reflected signal. The tests were conducted on the plumes from an800-foot stack of a coal-burning power station during two periods totaling 17 days in 1968. Measurements were made by scanning vertically at three azimuth angles. With the neodynium type of lidar used, the 20-30 measurements needed to probe each cross

section of the plume were taken in 3 to 5 minutes. The data collected was reduced to the equal-density contours. These experiments demonstrated the practicality of the lidar as an instrument for use in air pollution measurement and monitoring. Plume tilting and fanning or spreading of the plume are common. There are significant vertical variations in stability and wind structure that have profound effects on plume behavior which are not taken into account by existing theories of plume rise. In addition to the application of lidar to pollution studies, lidar is well suited for defining cloud structure and dimensions of the pollutant clouds hanging over major cities.

5502 APTIC NUMBER 15337

Stanley, Thomas W., Myrna J. Morgan, and James E. Meeker
RAPID ESTIMATION OF 7H-BENZ(DE)ANTHRACEN-7-ONE AND PHENALEN-1-ONE IN ORGANIC EXTRACTS OF AIRBORNE PARTICULATES FROM 3-HOUR SEQUENTIAL AIR SAMPLES. Environ. Sci. Technol., 3(11):1198-1200, Nov. 1969. 5 refs. (Presented at the Div. of Water, Air, and Waste Chemistry, American Chemical Society, 156th Annual Meeting, Atlantic City, N. J., Sept. 1968.)

Thin-layer chromatography using glass-fiber paper impregnated with silica gel was used to separate 7H-benz(de)anthracen-7-one and phenalen-1-one found in acetone extracts of airborne particulates from 3-hr sequential air samples. Only 15 min was required to separate 0.2-1.25 mg of the crude extract with 19:1 pentane-ether. Direct fluorometric measurement and scanning at F 418/550 and F 409/490 indicated concentrations ranging from 2 to 48 micrograms/1000 cu m of air for 7H-benz(de)anthracen-7-one and from 0.3 to 17 for phenalen-1-one. For 7H-benz(de)anthracen-7-one, the precision of the method calculated as relative standard deviation was approximately 3.2%, with a detection limit at 5 nanograms. For phenalen-1-one, the precision was approximately 1.0%, with a detection limit at 2 nanograms. The method was applied in analysis of 3-hr sequential air samples taken with Hi-Vol samplers over two 24-hr periods during January 1968 in polluted urban atmospheres. In the absence of detailed meteorological and land-use data, no meaningful conclusions can be drawn to explain changes in concentrations of these compounds during the 24-hr periods investigated. At the same site used for this investigation, a different diurnal distribution pattern was observed for four polynuclear aromatic hydrocarbons. However, the distribution patterns were consistent with peak concentrations occurring from 6-9 a.m. and from 3-6 p.m. The direct spectrophotofluorometric procedure reported in this paper and similar procedures show potential for application to more comprehensive air pollution studies.

5503 APTIC NUMBER 10773

Starshov, Y. M. and G. Ya. Ivanova
DETECTION OF TRACE QUANTITIES OF DICHLOROETHANE IN AIR. (Opredeleniye mikrokolichestva dikhloretana v vozdukhe). Text in Russian. Gigiena i Sanit., no. 7:54-55, 1969. 4 refs.

Chromatographic detection of dichloroethane using a DIP-1 chromatograph is described. Analysis takes four minutes and is sensitive to a concentration of 0.005 g dichloroethane per liter of air. This equipment is suitable for single determination or for continuous monitoring. Preparation and calibration of the column is described.

5504 APTIC NUMBER 10870

Steger, Eberhard and Hermann Fahl
THE ANALYSIS OF GASEOUS AIR CONTAMINATIONS BY INFRARED SPECTROSCOPY. (Die ultrarotspektroskopische Analyse gasformiger Luftverunreinigungen). Text in German. Chem. Tech. (Berlin), 21(8):483-488, Aug. 1969. 43 refs.

The detection thresholds of infrared spectrometry were determined for diethylether, carbon tetrachloride, benzene, acetone, methanol, carbon dioxide, sulfur dioxide, hydrogen sulfide, propane, and acetylene in the gaseous state. The recorded spectra were analyzed by the method of Wright. In all analyses of the gases, such influences as pressure and interference by other compounds must be taken into account. It is important to use the same pressure for the measurement and the calibration. Interfering substances, particularly H2O, were eliminated by use of the drying agent calcium chloride. Study of mutual interference showed that only methanol was slightly influenced by diethylether. The error calculation method for evaluation was used when the average value was determined from at least five measurements. The detection thresholds found for the substances measured are listed. It is concluded that infrared spectrometry can be used for gas analyses in the concentration range of the threshold limit value for eight hours (with the exception of H2S). It is not good enough, however, for concentrations in the range of maximum allowable values in the atmosphere.

5505 APTIC NUMBER 10735

Steinke, Irmhild
CONTRIBUTION TO THE DETERMINATION OF SO2 AND SO3 IN WASTE GASES. (Beitrag zur potentiometrischen Bestimmung von SO2 und SO3 in Abgasen). Text in German. Z. Anal. Chem., 244(4):253-258, 1969. 3 refs.

In the determination of sulfur trioxide and sulfuric acid aerosols in the presence of sulfur dioxide, the latter substance is oxidized to SO3 and both oxides are determined jointly. After additional determination of the SO2 content, the SO3 content is obtained from the difference. In experiments to test this method, both oxides were absorbed in NaOH/H2O2 solution. Woulff's absorbing flask was used for this purpose. Gas components which are not immediately absorbed will be absorbed after shaking. In this alkaline solution, the SO3 (composed of SO3 and the oxidized SO2) is present in form of sulfate ions, which are best determined by the method of Baudisch, Beilstein, and Neuenhausen to an accuracy of plus or minus 0.16 mg. The SO2 concentration was separately determined by absorption in Na2[HgCl4] solution (West and Gaeke method). By this approach, the SO2 and SO3 concentrations in waste gases from sulfuric acid plants can be determined to a minimum concentration of 1 g/cu m plus or minus 0.07 g/cu m.

5506 APTIC NUMBER 15708

Stoeber, Werner and Hermann Flachsbart
SIZE-SEPARATING PRECIPITATION OF AEROSOLS IN A SPINNING SPIRAL DUCT. Environ. Sci. Technol., 3(12):1280-1296, Dec. 1969. 18 refs. (Presented at 156th Meeting of the American Chemical Society, Atlantic City, N. J., Sept. 8-13, 1968.)

A new instrument is described which facilitates particle size spectrometry and size distribution analysis of aerosols in terms of aerodynamic diameters. The aerosol particles are precipitated according to their aerodynamic size along a strip foil about 100 cm in length. This foil forms the outer wall of a spiral duct, which is cut into a plane disk mounted on the rotor of a special centrifuge. Aerosol flow rates of up to 3 liters per minute can be fed into the centrifuge rotor at the center of rotation, where the aerosol is entrained into a laminar flow of clean air passing by the aerosol inlet and traveling through the spiral duct to the perimeter of the rotor. Total flow rate, aerosol intake, and rotor speed can be varied independently. This provides various operating conditions to be set for optimum performance with regard to deposition range, sampling rate, and size resolution. During a single test run, the instrument precipitates aerosol particles that differ in size by about two orders of magnitude. Best results are obtained at a rotor speed of 3000 rpm, where the centrifuge precipitates aerosol particles of sizes between 0.0005 cm and at least 0.000008 cm in diameter with a reasonably high degree of size resolution in different locations along the strip foil. For sizes above 0.00003 cm, an excellent size resolution is obtained which facilitates the determination of aerodynamic diameters of aggregates of uniform spheres which differ only by their geometrical configuration. Calibration curves as obtained with latex spheres under different operating conditions are given to demonstrate the performance of the instrument. The influence of secondary flow patterns in the spiral duct is investigated, and an estimate of the entrance losses of the aerosol is given. (Author abstract modified)

5507 APTIC NUMBER 10518

Strange, John P.
COMMENTS ON CATALYSTS AS SENSORS AND CONVERTERS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 811-819.

Hopcalite, platinum black, and nickel powder can be used directly as sensors or as converters to produce compounds more readily measured than the contaminant as it exists. Hopcalite, which oxidizes carbon monoxide to carbon dioxide, is an early example of a catalyst used as a sensor. Instruments with cells containing the catalyst are still used to monitor toxic gas concentrations in vehicular tunnels, steel mills, parking garages, and similar areas. Later instruments have replaced early thermocouples with thermistors in a resistance-type circuit. By monitoring solvent recovery plants, sensors equipped with remote sensing heads and Wheatstone bridge circuits are important in air pollution prevention. A third type of sensor, used in measuring ozone in the upper atmosphere, employs Hopcalite or platinum black to decompose ozone. The heat evolved is sensed with a thermistor. Conversion of compounds to CO2 for infrared analysis, the hydrogenation of CO to CH4, and chemical colorimetric detection are made possible by catalytic converters. Because of self-poisoning from products of incomplete combustion, the sensor is not practical for laboratory use. In the laboratory, electron capture detectors are more satisfactory.

5508 APTIC NUMBER 10899

Suzuki, S., F. Nishiyama, M. Kajimoto, N. Fujii, and T. Kondo
ON THE MANGANESE CONTENT OF DOG'S ORGANS IN YOKKAICH AREA. (Yokkaichi chiiki no inu no zoki chu Mn ryo ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1): 86, April 1969.

Desulfurization of waste gases by the manganese dioxide method is under investigation at a power company pilot plant in Yokkaichi. Emission of manganese from this plant was studied by examining the manganese content of liver, kidney, lung, and heart tissues from 45 local dogs. Atomic absorption spectrophotometric analysis of dried and ashed samples revealed the following manganese values based on fresh weight of organs: liver, 3.35 ppm; kidney, 1.28 ppm; lung, 0.53 ppm; heart, 0.41 ppm. Manganese values of these organs based on dry weight are 11.38, 5.87, 2.51, and 1.76 ppm, respectively.

5509 APTIC NUMBER 10895

Suzuki, Y., T. Kondo, N. Fujii, and M. Kajimoto
AN AMOUNT OF MANGANESE OF DUST ON GUTTER IN AREA AROUND MANGANESE TREATING FACTORY. (Mn toriatsukai koio shuhen no hido Mn ryo ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):87, April 1969.

Environmental pollution caused by a factory producing ferromanganese was studied by examining the manganese content of dust collected in gutters of private homes in the area of the plant. Manganese content, as determined by atomic absorption analysis, ranged from 1265 to 268,583 ppm. Dust collected at points 500 m or less from the factory had the highest average manganese values and that from distances of 500 to 1000 m the next highest average values. The lowest average values were obtained for dust from homes 2000 m from the factory. Results indicate that dust on gutters can serve as an indicator of pollution by insoluble heavy metals.

5510 APTIC NUMBER 13614

Takeuchi, Nabuhiko
A STUDY OF THE ABSORPTION OF SO2 IN WATER BY LIQUID JET. Translated from Japanese. (Source Unknown), p. 41-45, July 8, 1968

The diffusion coefficient of SO2 has been measured at 30 degrees C by using a liquid jet out of a bell-shaped nozzle. Six glass nozzles were used with pore sizes between 0.11 and 0.06 cm in diameter. The liquid jet was about 2 cm long and was in contact with SO2 gas from 2.9 times 10 to the minus 3 to 1.7 times 10 to the minus 2 sec. The amount of absorbed SO2 was determined by potentiometric titration with KMnO2 under slightly alkaline conditions. The actual value agrees well with those values calculated using Scheible's formula.

5511 APTIC NUMBER 15606

Tani, Tamio and Kimio Kato
RESULTS OF EVALUATION AND PERFORMANCE OF MODEL 68-5 SO2 ANALYZER/RECORDER. (Aryusangasu renzokuteidosokutei kirokusochi (moderu 68-5 gata) no shiken kekka ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(12):1027-1029, Dec. 15, 1969.

The results of tests performed on the Model 68-5 SO2 Analyzer/Recorder (manufacturer not given) are reported. The operation procedure is based on the Thomas principle. Sample air is led through a hydrogen peroxide solution which produces sulfuric acid by the oxidation of sulfur. The sulfuric acid produced is detected by the fluctuation of conductivity, using platinum electrodes. Model 68-5 records the density of sulfurous gas through the amplifier. Its attributes include the following: relatively small size; light weight compared to the conventional types; and prompt measurement in a short time (10 minutes average time required). The sample cell is made of glass. The reagents used for the test were 1 l water with 30% hydrogen peroxide and 1 ml of 0.01 N sulfuric acid. A standard solution of sulfurous gas was used for calibration. The test covered the determination of a standard graduation; examination of the fixed zero point; constant air flow test; examination of sensitivity calibration; rosaniline test; and a comparison of Model 68-5 with instruments made by other companies. Model 68-5 was observed to have stable electric systems and a slight sample air fluctuation. Based on the trial test carried out for five consecutive days, Model 68-5 was considered to constitute a continuous measurement for a considerable operation period.

5512 APTIC NUMBER 15721

Terabe, Motoji and Masaoshu Nagata
COMPARATIVE STUDY ON SULFATION RATES BY LEAD DIOXIDE CANDLE METHODS USING VARIOUS KINDS OF SHELTERS. (Nisanka namari ho ni yoru iou sankabutsu sokuteiho no hyojunka ni kansuru kenkyu). Text in Japanese. Sanoyo Kogai (Ind. Public Nuisance), 5(7):826-833, July 1969. 7 refs.

Autometers for measuring sulfur dioxide have been extensively used for monitoring air pollution; however, the lead dioxide method is often used as a simple method of measuring average pollution in certain regions. To use this method efficiently, measurements in various regions must be taken and compared with each other. However, disagreement among measured values due to the difference in quality of lead dioxide as well as the configuration of the candle shelter are serious obstacles, and their standardization is necessary. Measurements were conducted in the business district of Tsago from May 1966 through April 1968 and the heavy industrial district of Ohgimachi in Kawasaki from May 1967 through April 1968 using different kinds of shelter. The lead dioxide was examined by the English Standard Association. The shelters included Hasegawa, Kimoto, and Kawasaki Shelters of Japanese origin; the National Air Surveillance Network (NASN) Shelter and Square Shelter of U. S. origin; and the British Standard Shelter of England. The candle on which lead dioxide was spread was made of ceramics, glass, or plastics. The amount of lead dioxide used was 4 or 8 grams. Repeatability of the sulfation rate was measured for the Hasegawa, NASN, and Square Shelters; the deviation rate of the Hasegawa Shelter was 3.85% the NASN Shelter, 2.43%; and the Square Shelter, 3.02%. The NASN Shelter was the best of the three. The difference of sulfation rates using different amounts of lead dioxide on the cylinder was also studied. Four grams of lead dioxide was enough for moderately polluted regions; for heavily polluted regions, more study is needed. The difference in sulfation rates for the different shelters was also examined. The rate of the British Standard Shelter was taken as 100 mg SO3/100 sq cm/day, the corresponding rates were as follows: the Hasegawa Shelter was 68 mg SO3/100 sq cm/day; the NASN Shelter, 88 mg SO3/100 sq cm/day; the Square Shelter, 78 mg SO3/100 sq cm/day; the Kimoto Shelter, 106 mg SO3/100 sq cm/day and the Kawasaki Shelter, 79 mg SO3/100 sq cm/day.

5513 APTIC NUMBER 15621

Terabe, Motoji
DETERMINATION OF OXIDANTS IN THE ATMOSPHERE. (Taiki chu no oxidant (ozone o fukumu) no sokuteiho. Kagaku bunsekiho o chushin to shite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 4(6):333-339, June 15, 1968. 8 refs.

Three elementary methods for the chemical analysis of oxidants in the air are described in detail and compared: the buffered-potassium iodide method, the alkaline potassium iodide method, and the phenolphthalein method. Air is passed through the solution containing potassium iodide, and the isolated iodide is measured. The neutral buffered-potassium iodide method can measure an oxidant from several ppbm to about 10% and is easier to use and more accurate than the alkaline potassium iodide method. The absorbing solution consists of 0.1 M sodium phosphate and 0.1 M potassium phosphate containing 1% potassium iodide. The optical absorption of the isolated iodide is measured a half an hour to one hour after sampling using a 352 millimicron light. Iodide is isolated by chlorine, hydrogen, peroxide, ozone, and so forth. The alkaline potassium iodide method can measure an oxidant from 2.3 ppbm to about 20 ppm. The merit of this method is that it allows analysis a long time after sampling. The absorbing solution is 1 N sodium hydroxide containing 1% potassium iodide. The solution can be stored for several days. To isolate the iodide a phosphoric acid-sulfamic acid reagent is added. The phenolphthalein method can measure 0.01 to 0.25 ppm ozone when 10 liters of air are used. By regulating the air sample, a wider range of concentration can be covered. Analytical methods for

oxidant determination used in the U.S.A. are also explained. Measured values of oxidants in the U.S.A. are tabulated, particularly those in Los Angeles.

5514 APTIC NUMBER 15642

Terabe, Motoji
MEASUREMENTS OF DUST FALL AND SUSPENDED PARTICULATE MATTER. (Saijin sokutei to sono sokuteikiki ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(10):777-784, Oct. 10, 1969. 5 refs.

A general classification of dusts in dust fall and suspended particulate matter was presented with an emphasis on sampling and measurement devices. Various types of instruments described are practical and recently developed for dust measurement. The widely used devices for dust fall measurement are the deposit gauge and dust jar. For suspended particulate matter measurement, the tape sampler, high-volume sampler, and digital dust meter (automatic recording system) were discussed. The Andersen Dust Sampler was described. The results of a comparative study on the numerical values obtained by several types of samplers, conducted in July, September to October of 1968, and January of 1969 indicated a proportional relationship among the numerical values. Five kinds of samplers were examined: high-volume sampler, cyclone high-volume sampler, tape sampler, digital dust meter, and digital dust meter proofer. Daily averages measured by tape sampler had a close correlation with those of the high-volume sampler. The proportional relationship of total average was found to be 1 C(ohs)/1000 ft equals 100 microgram/cu m. Results of the digital dust meter for respirable dust movement were included.

5515 APTIC NUMBER 13759

Terabi, Motoji
PRESENT STATUS OF AIR POLLUTION AND STANDARDS FOR AMBIENT AIR SYSTEMS. (Taiki osen no genjo to kankyo-kijun ni tsuite). Text in Japanese. Kagaku Kogaku (Tokyo), 3(2):110-115, 1967. 12 refs.

Falling dust, floating dust, and sulfur oxides are three important factors in evaluating the severity of air pollution. Falling dust was collected and measured by a deposit gauge made in Japan with a unit of tons/sq km/month, and then qualitatively and quantitatively analyzed. The city of Osaka showed the greatest amount of falling dust (60 tons/sq km/month) during the period October 1962-September 1963. Floating dust was collected by the high-volume sampler (Hi-Vol), which has a fiber-glass filter of 8 x 10 inches), and was measured in micrograms/cu m. Sulfur oxides (SO2 or SO2 plus SO3) were measured by the West and Gaeke method, using the rose-aniline-formaldehyde, lead-dioxide technique. Automatic measurement of SO2 (and SO3) was made by using the electricity conduction ratio. Laws relating to the standards of ambient-air systems were adopted in Japan in June 1962, and the government has continuously monitored the factories which emit harmful gases since then. Seventeen cities and their vicinities, including Osaka, Tokyo, and Yokohama, have been designated by law as air-polluted areas since 1962.

5516 APTIC NUMBER 15586

Trieff, N. M., P. Odev-Sule, S. Field, and F. Gabriel
ANALYSIS OF CARBONYL GROUPING IN TRACE VOLATYLES BY A GAS CHROMATOGRAPHIC TRAPPING METHOD. Preprint, Drexel Inst. of Technology, Philadelphia, Pa., Environmental Engineering and Science Program, 13p., 1969(?). 8 refs.

A complex chromatographic technique is described for determining odorous carbonyl group components of industrial grouping, plant emissions, such as those from rendering plants. The technique involves sucking the vapors in the field on to a matrix of glass beads contained in a U-tube and immersed in liquid nitrogen. Initially, the untreated U-tube serves as a pre-column on the gas chromatograph. Treatment to remove the carbonyl peaks requires collection on the U-tube containing solid 2,4-dinitrophenylhydrazine, heating in an explosive-proof oven, and sucking the volitale components on to another U-tube containing glass beads and immersed in liquid nitrogen. In laboratory tests, over 90% removal was obtained for aldehydes and ketones. Tentative analysis of field samples from a rendering plant suggests that they contain carbonyl groups.

5517 APTIC NUMBER 15909

Tsuda, Mitsushige, Shigekazu Hatano, and Ykuji Mizuta
CONTINUOUS SAMPLING OF AUTOMOBILE EXHAUST GAS AND ADJUSTMENT OF STANDARD GASES. Mitsubishi Heavy Industries, Ltd., Tech. Rev., 6(3):80-86, Sept. 1969. 8 refs.

Among the problems involved in analyzing automobile exhaust are the techniques to be used in continous exhaust gas sampling and in handling the standard gas to be used for calibration of the analytical equipment. Cooling and dehumidifying of exhaust gas is of particular importance in continous sampling. The cooling temperature must be maintained below 41 F. Selection of materials for the gas channel of an analyzer and the prevention of hydrocarbon adhesion to filter surfaces are of particular importance in minimizing measurement errors. To increase the responsiveness of the analyzer, the volume of gas passage inside the channel must be as small as possible and the flow of sampled gas as large as possible. Continous measurement of total hydrocarbons in exhaust gas is possible by combining a continuous sampling channel with a flame ionization detector. The measuring range of such an analyzer is 100 to about 42,000 ppm methane and 15 to about 7000 ppm n-hexane. Required concentrations of the standard gas can be correctly determined by combustion methods for hydrocarbons and by the Orsat method for CO-CO2-O2 mixed gas. Standard gas whose concentration is guaranteed by the above methods should be used in calibrating an analyzer. (Author conclusions modified)

5518 APTIC NUMBER 15730

Tubina, A. Ya. and L. V. Mel'nikova
METHODS OF DETERMINATION OF NITROMETHANE AND NITROETHANE IN THE AIR PRODUCTION INSTALLATIONS. (Metody opredeleniya nitrometana i nitroetana v vozdukhe proizvodstvennykh pomeshcheniy). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, vol. 6:49-50, 1969.

A polarographic method for detecting nitromethane and nitroethane and a colorimetric method for detecting nitromethane in air are described. The polarographic method adequately detects 0.2 micrograms of nitromethane and 0.25 micrograms of nitroethane per milliliter of water. The colorimetric method is capable of detecting 0.2 micrograms of nitromethane in 2 milliliters of solution. A 0.2 liter air sample is thus adequate for detecting concentrations of these components at levels 3-15 times below permissible values.

5519 APTIC NUMBER 15581

Turk, Amos, Jack T. Morrow, Stephen H. Stoldt, and Warren Baecht
ENHANCED DESORPTION OF ATMOSPHERIC SAMPLES FROM ACTIVATED CARBON. Preprint, City Coll., New York, Dept. of Chemistry, 13p., (1963?), 7 refs.

Enhanced desorption techniques as compared with normal desorption provide significantly more information on the presence of contaminants in air, especially hydrocarbon materials, thus enabling sufficiently specific descriptions of individual atmospheres to afford valuable characterizations. The feasibility of enhanced desorption was first tested on butane and CCl_2F_2 using carbon tetrachloride as the displacing vapor. The enhancement of butane desorption ranged between 35% and 41%. The CCl_2F_2 desorption was also enhanced but to a lesser degree, possible due to the lesser difference in molecular weights between CCl_4 and CCl_2F_2 than between CCl_4 and butane. The percentage desorption of CCl_2F_2, with or without CCl_4, decreased in successive runs, accompanied by the formation of an insoluble white polymer that probably caused some pore blockage on the carbon surface. Preliminary tests on atmospheric samples using activated carbon (wherein carbon tetrachloride was allowed to adsorb into the carbon in vacuo and was then chromatographed) showed in increased response. Infrared spectra obtained from carbon samples exposed to air at gas sampling stations showed the following: 2360 and 2310 reciprocal cm peaks were probably CO_2; the broad 2080 reciprocal cm peak was indicative of CO; the 2940, 2920, and 2860 reciprocal cm bands were due to CH_2 and CH_3 group absorptions. Carbons of greater surface area per unit weight have a greater adsorption capacity and will adsorb more rapidly than carbons of more limited area. Charcoal with the smaller pore diameter has adsorbate molecules with a lower vapor pressure; diffusion through the narrower pores is more difficult.

5520 APTIC NUMBER 10886

Ohi, K.
THE DETERMINATION OF ACIDIC GASES IN WORKING ENVIRONMENTS BY ALKALI FILTER PAPER. (Alkali roshi ho ni yoru sagyo kankyo chu sansei gas no sokutei). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):49, April 1969.

The alkali filter paper method for determining acid gases in working environments entails soaking filter paper in a 30% potassium carbonate solution, drying the paper in air, and putting it in a vinyl holder having an exposure area of 68 sq cm. Absorbed gases are extracted with distilled water and determined qualitatively and quantitatively. The required exposure time is determined by the type of acid being measured, the production process, and the sensitivity of the determination method. Generally, 1 to 8 hrs are appropriate for acidic gases like SO_2, HCl, and NO_2, and 8 to 24 hrs for acid mists of sulfuric, phosphoric, and chromic acids. One hour is usually required for SO_2 measurements by the para-rosaniline formaline method; the Cl-Ba method requires 8 to 24 hrs. When the relationship between the amount of SO_2 adsorbed on the filter paper and the average gas concentration in the working environment is plotted, a curve is obtained. Thus, on a per day basis, the coefficient of conversion depends on the amount adsorbed. However, the graph for an hour of exposure time is linear, suggesting that shorter exposure times would be convenient for the calculation.

5521 APTIC NUMBER 15531

Uthe, E. E.
OPTICAL SOUNDING VI. (FINAL REPORT-PART VI). THE PROBLEMS OF REMOTE OPTICAL PROBING OF THE ATMOSPHERE: SOME EXPERIMENTS ON THE INVERSION OF GROUND BASED RADIANCE MEASUREMENTS. New York Univ., New York, School of Engineering and Science, Contract DA-36-039 AMC-03411(E), Proj. IVO-14501-B-53A-02-03, E-65-7, 25p., 1965. 16 refs.

The possibility of obtaining low level atmospheric temperature profiles from ground-based radiance measurements is evaluated. Low level temperature profiles are inferred from simulated ground-based atmospheric radiance measurements in the 4.3 micron CO_2 band. The inversion method compares these measurements with values obtained from a radiance model which is linearized by an assumed temperature profile. An error term is added to the radiance measurements. The solution to the unstable system of equations is determined by minimizing the sum of the squares of the departures from the linearization profile. An iteration method is then used to correct the radiance model. Results indicate that profiles containing a first order discontinuity give satisfactory inversions when measurement and model errors are within 2% accuracy. (Author abstract modified)

5522 APTIC NUMBER 10668

Vasak, V.
ATOMIC ABSORPTION SPECTROPHOTOMETRY: ITS USE IN INDUSTRIAL TOXICOLOGY. (Atomova absorpcni spektrofotometrie a její použití v průmyslové toxikologii). Text in Czech. Czech. Hyg., 13(2):105-110, 1968. 8 refs.

In atomic absorption spectrophotometry, the absorption of light is measured by passing a metal or biological specimen through

a flame to decompose it to elemental atoms. This method allows the quantitative determination of nearly 70 elements. A detailed description of the method is included. By introducing atomization at high temperatures, the author was able to greatly increase the number of elements detected. A flame of acetylene and nitrous oxide provided greatest sensitivity. Suitably fluidized solutions can be applied directly, but plant and biological specimens must be mineralized or ashed and the ash dissolved in a defined volume of acid. The most recommended solution for burning is methyl-ketol, which is very well suited for isolation of metals; chloride solutions are not suitable, as they influence the burning of the flame.

5523 APTIC NUMBER 15290

Vekeny, Henrik
DETERMINATION OF DUST CONCENTRATION IN THE HEALTH HAZARD RANGE WITH THE AID OF AN AIR PRESEPARATOR-EQUIPPED GRAVIMETER.
(Az egeszsegre veszelyes por koncentraciojanak meghatarozasa legszeparator elolevalasztasu gravimeterrel). Text in Hungarian. Banyasz. Lapok, 102(2):80-85, Feb. 1969. 21 refs.

A modification of the widely used gravimetric-type dust concentration measuring instrument is proposed, whereby the dust retaining characteristics of the human lung will be better simulated and close correlation between dust content of air and incidence of silicosis might be deduced. The two-stage air samplers are considered the best gravimetric-type instruments: the first stage separates the dust particles above 7.1 microns diameter, and the second stage retains the smaller, harmful fractions. Unfortunately, presently used first-stage separators (cyclones and laminar precipitators) frequently produce changes in the size distribution of the arrested dust or they permit the transit of coarse dust into the second stage under shop conditions. To prevent the consequent distortion of the test results, it is proposed that the cyclones or laminar precipitators of the first stage be replaced by separators using an upward-moving air column as the separating mechanism in the first stage. Development of such apparatus is underway in Hungary.

5524 APTIC NUMBER 14690

Wahnschaffe, F.
CONTINUOUS MEASUREMENTS OF THE SO3-CONTENT AND THE DEW-POINT RANGE IN OIL-FIRED STEAM GENERATORS. (Kontinuierliche SO3- und Taubereichsmessungen an oelgefeuerten Dampferzeugern). Text in German. Mitt. Ver. Grosskesselbesitzer, 98(3):193-199, June 1968. 3 refs.

In an oil-fired boiler furnace with a capacity of 175 tons/hr at 125 atm and 490 C, SO3 measurements were taken with the Sulfotherm unit. The measurement was greatly dependent on temperature; only between 580 and 600 C was it feasible to measure the entire SO3 content. Between 1400 and 600 C, SO2 is converted to SO3, but the reaction is never a complete one and some SO2 always remains. Determination of the degree of conversion is impossible, since at 580 C, the conversion of SO3 to H2SO4 begins. Study of dew point and dew point range measurements showed that these methods are also temperature-dependent. At 200 C, H2SO4 begins to precipitate as a film on the probe. The rate of film formation is temperature-independent between 120 and 135 C. Therefore, the measuring probe can be calibrated against the true SO3 concentration. Exact SO3 measurements are important for determining the amount of additives such as CaO, and MgO required to eliminate corrosive substances in the flue gas.

5525 APTIC NUMBER 14722

STUDY OF THE CONTINUOUS DETERMINATION OF ORGANIC SUBSTANCES WITH FLAME IONIZATION DETECTORS. (Beitrag zur kontinuierlichen Summenbestimmung organischer Substanzen mit Flammenionisationsdetektoren). Text in German. Wasser Luft Betrieb, 12(2):68-69, 1968. 8 refs.

Two hydrocarbon analyzers were used for continuous determination of gaseous organic substances in the air. They were set up in a busy street of Berlin and calibrated with 4.6 and 16.5 ppm methane in synthetic air. The recordings were evaluated by planimetry and half-hourly averages were computed. From these, the daily averages were computed for a total of 20 measurement days. From the daily averages for a concentration range of 2.0 to 7.3 ppm methane, a standard deviation of 0.46 ppm was obtained. The results showed that the flame ionization detector can be used for such measurements if it is carefully calibrated and serviced.

5526 APTIC NUMBER 14959

Watanabe, A.
THE FEASIBILITY OF DETECTING FOG BY MEANS OF A LASER.
(Defence Research Telecommunications Establishment, Ottawa, Ontario, Electronics Lab., DRTE Report 1177, 9p., Dec. 1966. 3 refs.

Suggestions for the detection of sea fog by means of a laser are presented. One method makes use of backscattered radiation due to the multiple reflection and refraction from the small droplets of water in the approaching fog. If a laser beam is directed at the fog, then the scattered radiation may be intercepted by a receiver and detected. Another possibility is to use the extinction properties of the fog when it moves into the direct path of a transmitted beam of radiation, laser or noncoherent. Two factors make unambiguous detection of a fog by the backscattering of laser radiation extremely difficult. The first is that the backscattered laser radiation may have to compete with the sunlight scattered by the fog or reflected by surfaces in the field of view of the receiver. The second is that the inverse square dependence on the range of the scattered intensity intercepted by the receiver makes it difficult to distinguish between strong scattering at long range and weak scattering at short ranges. In considering the possible methods, the interfering effects of scattered sunlight, the detection of backscatter with a range-gated system, the detection possibilities

of a narrow-band amplifier at the pulse repetition frequency, and the signal-to-noise properties of the range-gated systems are discussed. Crude calculations showed that, with present lasers, the range at which moderate fog can be detected by means of backscattered radiation is only about 50 meters. The detection of fog by the measurement of the attentuation in an optical beam traversing the fog will not give any forwarning of a fog bank rolling in from the sea.

5527 APTIC NUMBER 15582

Whitby, K. T., R. C. Jordan, and C. M. Peterson
GENERATION AND DECAY OF SMALL IONS: DEVELOPMENT OF AN ELECTRIC PARTICLE COUNTER SYSTEM AND DEVELOPMENT OF A TECHNIQUE FOR STUDYING THE CHARGE ON AN EVAPORATING DROP (PROGRESS REPORT). Minnesota Univ., Minneapolis, Dept. of Mechanical Engineering, Grant AP 00136-03, Pub-80, 82p., June 1, 1968. 8 refs.

The design, construction, and initial evaluation of an electrical particle counter system capable of rapid, in situ, measurement of aerosol concentration and particle size distribution over the range from 0.015 to 2 microns are described. Initial measurements of natural laboratory aerosols show satisfactory agreement with the Royco optical particle counter in the size range where they overlap. Simultaneous operation of an automatic condensation nuclei counter, the electric particle counter, and the Royco counter permit rapid measurement of aerosol size distribution from molecular to 10 microns. The two key elements of the new system are a special sonic jet diffusion charger and a new mobility analyzer. The charger uses aerosol recirculation, making it possible to charge a high fraction of small particles with a low concentration charging time product while maintaining a mobility minimum at about 3 microns. The mobility analyzer utilizes a region where an electric precipitating field exists followed by a current collector to obtain high resolution, mobility measurements down to 0.0002 cm/sec per volt/cm with a 1 cfm aerosol flow rate. Two techniques were developed for studing of electric charge on evaporating drops smaller than 50 microns. For drops between 10-50 microns, inductive charging of the droplets generated by a spinning disk atomizer is used. The drop size of the suspended drops is measured by continuously photographing the amplitude of oscillation of the drops in a low frequency AC field superimposed on the DC field. For smaller drops, apparatus for bipolarly charging small particles by condensation and evaporation is used to form and charges drops on a nucleating aerosol of known size. The final charge after evaporation is then measured with the mobility analyzer. It is hoped that this technique will produce data down to a fraction of a micron.

5528 APTIC NUMBER 15824

Wickert, Kurt
SO3-DETERMINATION IN DUST-LADEN AND DUST-FREE COMBUSTION GASES. (SO3-Bestimmung in staubhaltigen und staubfreien Verbrennungsgasen). Text in German. Erdoel Kohle (Hamburg), 20(8):568-572, Aug. 1967. 2 refs.

Analytical tests are described which allow an exact determition of the SO3 contained in dust-laden combustion gases. If there is dust in the gas which is retained in the apparatus for determining the SO3, it will react with the SO3 or the sulfuric acid, causing inaccurate results. The more dust there is, the higher the discrepancy. In the analytical method described, the dust is taken into account. Flue gases conveyed by a 100 m-long polyethylene pipe from the stack of a coal-fired boiler were freed of water vapor, H2SO4, and dust and mixed with water vapor-saturated ambient air in various proportions. This SO2-containing mixture was passed first through a heated catalytic tube filled with quartz wool coated with platinum black, in which the SO2 was oxidized to SO3, and then to a sulfuric acid condensation tube at 70 C filled with a layer of asbestos for collecting the acid mist. A temperature of 300 C or more must be maintained at the junction of the catalytic and condensation tubes. After a test run with a known amount of flue gas-air mixture, the condensation tube was flushed out and the amount of H2SO4 present in the fresh water, and hence, the SO2 content of that mixture, was determined. An industrial version of this method is described and includes a subsidiary determination of the SO3 content of fly ash prior to and after its retention in the dust collector.

5529 APTIC NUMBER 15358

Wilson, K. W., C. J. Doyle, D. A. Hansen, and R. D. Englert
PHOTOCHEMICAL REACTIVITY OF TRICHLOROETHYLENE AND OTHER SOLVENTS. Am. Chem. Soc. Div. Org. Coatings Plastics Chem. Preprints, 29(2):889-899, 1969. 6 refs. (Presented at the 158th Meeting of the Am. Chem. Soc., Div. Organic Coatings and Plastics Chemistry, New York, Sept. 1969.)

A special smog chamber was built to study the slowly reacting solvents which, in the presence of nitrogen oxides, form smog much more slowly than do automobile exhausts. The chamber has Pyrex panels with an access wall of cast aluminum. The aluminum wall incorporates eye ports for measurement of eye irritation, an access hole for the optics of a multireflection infrared cell, and sampling ports through which gas is removed for wet chemical analysis. An air purification system for the chamber removes contaminants by catalytic combustion over platinum at 5-8 atm and 500 to 600 C and cools the purified air to below 327 C and about 1 atm. Performance of the chamber was validat-ed by charging it with test hydrocarbons, e.g., ethylene, cyclohexane, tricholoroethylene, xylenes, and paraffins at 1, 4, or 8 ppm and nitric oxide at 0.25, 1, or 2 ppm. The photooxidation experiments show that the rate of photochemical smog formation decreases as the hydrocarbon:nitric oxide ratio decreases and that eye irritation is caused primarily by formaldehyde. As judged by its rate of disappearance, trichloroethylene is less reactive than ethylene. Trends observed with changing concentrations of trichloroethylene also suggest that average atmospheric concentrations of trichloroethylene would produce no eye irritation or other measurable smog symptoms.

5530 APTIC NUMBER 15897

Winefordner, J. D.
NEW ATOMIC SPECTROSCOPIC METHODS FOR TRACE ANALYSIS. Proc.

Office Aerospace Res., Res. Appl. Conf. March 13, 1969, vol. 1:B-1 to B-19. OAR 69-0011. 6 refs.
CFSTI: AD 692500

The importance of trace metal determinations in biological fluids, air and water pollution samples, and in lubricating fluids is well-known. New spectrochemical methods for determinations in synthetic samples are discussed. The techniques include: atomic fluorescence flame spectrometry, atomic fluorescence spectrometry with a graphite furnace, and atomic absorption spectroscopy with a graphite furnace. In the first two methods, a sample is atomized and the resulting atoms are excited by a light source. The light emitted when the atoms become de-excited is measured and is directly related to the number of atoms excited. In the absorption method, the sample is atomized and the resulting atomic vapor is measured by a standard light absorption method. The first technique uses a flame is used to atomize the sample, the others a graphite furnace at about 2000 C. These techniques ensure selective and accurate measurements of amounts 10 to the minus tenth grams of some metals in small amounts of solution (0.01 milliliter). The advantages and disadvantages of these techniques are stressed, particularly for monitoring wear metals in lubricating fluids to determine improper engine operation or predict engine malfunctions in diesel, reciprocating and jet engines. (Author abstract modified)

5531 APTIC NUMBER 15559

Wolfson, Bernard T.
DROPLET SIZE MEASUREMENT BY LIGHT SCATTERING. Aerospace Res. Rev., 3(9):8-11, Nov. 1968. 6 refs.
CFSTI, DDC: AD 685803

The method of measuring the mean droplet size of evaporating sprays encountered in various propulsion devices is based on small-angle diffractive scattering of light. When light falls upon a sperical body, the direction of propagation of light incident to the transparent sphere is altered by the following effects: light directly impinging upon the particle is refracted and reflected, or simply reflected; successive internal reflections weaken the intensity of a ray within the sphere due to refractive escape of a fraction of the energy; and there may be internal absorption of luminous energy and conversion to thermal or chemical energy. Rays which are affected by the proximity of the drop are diffractively scattered while those incident upon the drop are referred to as non-diffractively scattered. However, if the diameter of the sphere is not large compared to the wavelength of light, then it is necessary to apply electromagnetic theory in order to determine the effect of the sphere on the incident electromagnetic radiation. The optical apparatus has the following implications: a particle moving within a beam of light produces a diffraction pattern in the reception plane identical to the pattern produced by the particle fixed in space within the beam, therefore displaying an apparent motion stopping capability; a group of particles present within the beam will produce a scattered light pattern that is the same as though each particle were located independently at the principal point of the receiving lens, thus providing thy property of superimposing or integrating the diffraction patterns produced by a large number of particles; and the integrated diffraction pattern created by a group of particles in continuous motion through the collimated beam will remain steady in time provided the concentration and size-distribution of those particles contained within the beam are independent in time.

5532 APTIC NUMBER 15553

Woomert, D. F.
RESEARCH TEST TO EVALUATE THE TECHNIQUES AND PRECISION OF THE MEASUREMENT OF SMOKE FROM DIESEL ENGINES. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., Development and Proof Services, Prod. 1A024801A106, Rept. DPS-1208, 28p., March 1968. 1 ref.
CFSTI, DDC: AD 837342

A cooperative project was established by the Army and industry to evaluate the many instruments available for the purpose of establishing operating and sampling techniques, as well as a common set of units or scale to define smoke with respect to diesel engines. Each of the basic types of smokemeters produced commercially has a definite area of application. Smokemeter operating techniques and a common smoke density scale were established. Visual ratings are very dependent on surrounding factors and are an unreliable means of defining smoke. (Author abstract modified)

5533 APTIC NUMBER 15172

Yamate, Noboru, Tosiro Matsumura, and Masaharu Tonomura
CONTINUOUS DETERMINATION OF FORMALDEHYDE IN THE ATMOSPHERE BY USE OF SPECTROPHOTOMETRIC ANALYSIS. (Taikichu horumuarudehido no hishokuho ni yoru renzoku sokutei ni tsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 86:58-68, 1968. 6 refs.

The continuous determination of formaldehyde in the air using an acetylacetone reagent is described. Measurements were made every hour with an automatic, continuous analyzer having a single-path colorimeter. The air sample was bubbled into a gas-absorbing bubbler containing 50 ml of acetylacetone for 58.5 min at a constant rate of 2 l/min. The absorbance of formaldehyde-containing acetylacetone was measured at 420 millimicrons. The concentration of formaldehyde was then plotted by a recorder, which was graduated from 0-20 ppm. This analyzer has been in use since 1967 at the Continuous Air Monitoring Station in the Kasumigaseki section of Tokyo. (Author abstract modified)

5534 APTIC NUMBER 15171

Yamate, Noboru
MANUAL METHODS AND AUTOMATIC CONTINUOUS INSTRUMENTS FOR MEASUREMENT OF GASEOUS AIR POLLUTANTS. (Gasujo taiki osenshitsu no sokutei to sono sokuteikiki). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(10):795-796, Oct. 1969. 36 refs.

In order to prevent air pollution, measurement of pollutant concentrations must be continuously performed. In this report, both continuous monitoring and manual analyses of typical air pollutants are reviewed. Numerous methods are tabulated and most of them are explained, with particular attention to continuous methods and apparatus. Sulfides are measured manually by colorimetric analysis with rosaniline or barium molybdate, by the lead per oxide method, or by test paper methods. Sulfides are also measured continuously by means of solution conductance (Thomas autometer) or by optical absorption with rosaniline or with iodine-starch. Carbon monoxide is measured manually with palladium sulfate and ammonium molybdate, by gas chromatography, or by the hopcalite method. It is measured continuously by infrared or ultraviolet absorption of reduced mercuric oxide. Nitrides are measured manually by the Saltzman or the Jacobs method, or with ortho-tolidine sulfate. Hydrogen sulfide is measured manually by methylene blue and continuously by a colorimetric filter paper method. Hydrocarbons are measured manually by gas chromatography and continuously by flame ionization detectors. Formaldehyde is measured manually by colorimetric analysis with a chromotropic acid or with acetylacetone, or by the MBTH method. Ozone is measured manually by the phenolphthalein or the potassium iodide method and continuously by coulometric titration or by optical absorption with potassium iodide. Fluorides are measured manually by colorimetric analysis with thorium neothron(?) or lanthanum alizarin complex and continuously by filter paper fluorescence. Actual Tokyo data on changes in the concentrations of carbon monoxide, nitric oxide, and nitrogen dioxide are tabulated.

5535 APTIC NUMBER 18927

Zielinski, Emil
THE USE OF IONIZATION DETECTOR WITH 63 NI SOURCE FOR CHROMATOGRAPHIC DETERMINATION OF HYDROGEN SULFIDE, SULFUR DIOXIDE, AND CARBON OXYSULFIDE. (Zastosowanie detektora argonowo-triodowego z preparatem 63 Ni do oznaczen chromatograficznych siarkowodoru, dwutlenku siarki i tlenosiarczku wegla). Text in Polish. Chem. Anal. (Warsaw), 14(3):521-525, 1969. 5 refs.

Limits were determined for the detection of hydrogen sulfide, sulfur dioxide and carbon oxysulfide by an argon ionization detector with a Ni 63 source. For carbon oxysulfide and hydrogen sulfide the limit of detection was 0.0001% and 0.001% respectively. Both substances produced an increase in ionization current. Sulfur dioxide brought about a decrease in ionization current; the limit of detection was 0.005%. (Author abstract modified)

5536 APTIC NUMBER 18876

Zuev, V. E., M. V. Kabanov, and B. A. Savel'ev
THE LIMITS OF APPLICABILITY OF THE BOUGUER LAW IN SCATTERING MEDIA FOR COLLIMATED LIGHT BEAMS. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana), 3(7):414-418, July 1967. 17 refs.

According to existing theoretical investigations, the attenuation of direct, monochromatic radiation is described by Bouguer's law, whose limits of applicability are determined by the strength of the forward-scattered radiation. In the present investigation, the limits of the application of the law were experimentally determined for the propagation of a narrow collimated beam in different scattering media. Results, covering a range of optical depths, are given for thermal sources and lasers. Direct ray scheme measurements for wood smokes in a cloud chamber show no divergence from the exponential law over the range of optical depths. The law is applicable at depths up to tau equals 12. A limit to the law's applicability was found when measurements were made on the reflected scheme. This occurs at tau equals 23. The principal difference between the reflecting and direct ray schemes lies in the fact that, in addition to forward-scattered radiation, the receiving system records back-scattered radiation from the beam travelling from the collimator to the mirror. Measurements using the reflecting scheme show the limit of applicability is the same for water fogs and wood smokes. This means that the brightness of the back-scattered light does not depend on the optical properties of the scattering medium at these optical depths. Applicability of the law in a model medium is restricted to comparatively small ranges of optical depths.

5537 APTIC NUMBER 15397

REPORT ON AIR POLLUTION MEASUREMENTS 1965-1967 IN COPENHAGEN, AALBORG-HORRESUNDBY, ODENSE, VEJLE AND MARIBO. (Rapport over luftforureningsmalinger 1965-1967 i Kobenhaven, Aalborg-Horresundby, Odense, Vejle og Maribo). Text in Danish. Academy of Technical Sciences, Copenhagen, Denmark, Air Pollution Committee, Rogudvalget 62, 180p. (2 vols.), Sept. 1968. 39 refs.

Measurement by standardized methods were made of dustfall, suspended matter, and sulfur dioxide in the atmosphere of 5 Danish cities from 1965 to the beginning of 1967. The average dustfall values for all 30-day periods in 1965 for all stations are given in the report, as well as all measurements of particulates and SO2. Permissible maximum values were chosen to permit comparison of data with that from other countries. For all cities, the yearly average dustfall was lower than the limit value. Maximum monthly values did not always fall within the heating season, implying the possible effect of such factors as traffic dust, plant sources, and meteorologic and topographic conditions. The average dustfall in Copenhagen was only 46% of the 1944/45 value. The yearly average values for suspended matter were below the limit value of 75 micrograms/cu m for all cities, despite some individual stations which had 24-hour values in excess of the 150 microgram/cu m maximum. Variations in suspended dust content occurred in all the cities at the same time, possibly because of widespread inversions. With the exception of Vejle, the provincial towns generally had low SO2 values; however, several Copenhagen stations reached or exceeded the monthly values limit of 0.150 mg/cu m, and many measurements exceeded the 24-hour limits of .30 mg/cu m. High SO2 content often coincided with high value for suspended matter, again implicating local inversions. Supplementary investigations pointed up the serious problem of a considerable increase in the acidity of rainfall over Copenhagen since 1944/45. On the basis of the program of measurements, it is concluded that air pollution in Denmark is generally not yet a serious problem, although several local areas require closer investigations and some improvements. The establishment of a permanent national air pollution agency is recommended, as well as the need for international cooperation in pollution control.

5538 APTIC NUMBER 15538

COMMISSION ON EARTH, WATER AND AIR, ROTTERDAM. Annual Report 1968. (Verslag over het jaar 1968). Text in Dutch. 72p.

This report deals with the soil, water, and air pollution problems in the vicinity of Rotterdam. Thirty-three cases of soil pollution reported in 1968 were mainly due to leakage in underground tanks and pipes. The average chlorine content at low tides at the measuring station of the Boringerdijk reservoir was 139 mg/l, 7 mg/l lower than in 1967. The level of air pollution during 1968 was more or less constant in comparison with 1967. A study of the 1218 bronchitis complaints of male civil servants indicated that bronchitis occurs with increasing frequency in the age group above 40 and especially above 60. A study of chronic bronchitis and asthma in elementary school children in two sections of Rotterdam indicated that in Crooswijk, 5.5% of 455 children had chronic bronchitis and 2.2% had asthma. In Hillegersberg, 1.0% of 480 children had chronic bronchitis and 1.7% had asthma. Measurements of precipitation, smoke, polycyclic hydrocarbons, CO, ozone, NO2, and sulfur oxides are presented. The smoke meter results show a usual smoke content of 100 micrograms/cu m or more during long periods of mist which occur during the winter months. In the first and fourth quarters, the polycyclic hydrocarbon values were much smaller than those of 1968. Of 174 samples of carbon monoxide, 18 were more than 30 ppm; in 1967, only one sample was higher than 30 ppm. The highest lead content was 1.5 micrograms/cu m. Ozone content of the air was less than 20 micrograms/cu m on cloudy days. Nitrogen oxide concentration ranged from 100-150 micrograms/cu m. Ninety-one days were recorded with SO2 content equal to or greater than 350 micrograms/cu m, and 89 days were recorded with smoke content equal to or greater than 250 micrograms/cu m. The declining tendency for smoke pollution was attributed to the increasing use of natural gas.

5539 APTIC NUMBER 14998

Bath, T. D.
KANSAS CITY, KANSAS, AIR POLLUTION SURVEY. Midwest Research Inst., Kansas City, Mo., MRI Proj. 2869-C, Final Report, 45p., Nov. 6, 1968.

Experimental work and analysis performed by the Midwest Research Institute for Kansas City, Kan. in the development of an air pollution control program are discussed. Air quality data for settling particulates, suspended particulates, soiling index, sulfation rate, and levels of sulfur dioxide, oxidants and oxides of nitrogen were determined and tabulated. An emission inventory was performed and the results were correlated with the air quality data and meteorological data. This correlation shows that particulate pollutants are the air quality problem of most immediate concern. A 60 percent reduction of particulate emissions in the industrial regions of the city is recommended. Recommendations are also made for a continuing air quality monitoring program and for studies to determine background levels, possibilities of odor control and the interaction between air pollution control and water pollution. (Author summary modified)

5540 APTIC NUMBER 15598

Boccadoro, S. and M. Inciulla
THE DETERMINATION OF CO AS AN INDEX OF AIR POLLUTION IN SOME SHOPS AND PLACES IN THE CENTER OF FLORENCE. (Determinazione dell'ossido di carbonio come indice di inquinamento atmosferico da traffico motorizzato nei negozi e nelle abitazioni del centro di Firenze). Text in Italian. Ann. della Sanita Pubblica (Rome), 29(6):1507-1523, Nov.-Dec. 1968. 46 refs.

Carbon monoxide was chosen as an indicator for air pollution caused by automotive traffic in Florence, Italy. Prolonged exposure to 30 ppm of carbon monoxide causes the appearance of

carboxyhemoglobinemia. For the present study, a lower concentration was chosen to allow for other sources of carbon monoxide (such as cigarettes), higher sensitivity of subjects (due to age or health conditions), and the synergistic effect caused by a combination of CO with other pollutants. Three locations were chosen at intersections for air sampling, all located in the historic portion of Florence, Italy, where traffic is congested and moves slowly. Carbon monoxide determinations were made with a Draeger sampler, model 19/31, 3 times daily at each site (8-9 a.m.; noon-1 p.m.; 6-7p.m.). The testing period was between December, 1965 and December 1966, with an interruption in November 1966 due to the big flood. A total of 850 determinations were made. Of these, 298 gave a positive reading. In 265 cases, the indoor readings were below 30 ppm; in 27 cases, at 30 ppm; and in 6 cases, there were readings as high as 50 ppm. The intersection of via del Proconsolo and via Ghibellina gave the highest readings at every season of the year. At this intersection, the traffic almost comes to a standstill in order to negotiate a sharp turn. Outdoor readings ran as high as 150 ppm. It must be remembered that the CO concentrations do not represent the only risk to health of people living or working in the central part of the city, but are also indicative of high concentrations of other pollutants. The authors strongly recommend closing the historic section of Florence to all motor traffic.

5581 APTIC NUMBER 18657

Bourelly, Therese
STUDY OF AIR POLLUTION AT THE FOUR LEVELS OF THE EIFFEL TOWER. FIRST RESULTS (1967). (Etude de la pollution atmospherique aux quatre niveaux de la Tour Eiffel. Premiers resultats (1967)). Text in French. Pollut. Atmos. (Paris), 10(40):227-233, Oct.-Dec. 1968.

Air pollution at four different levels of the Eiffel Tower was studied by comparing soot levels with sulfur dioxide levels. The measuring apparatus, installed at each of the four levels, utilized the classical method of examining a filter paper which had been exposed to a stream of polluted air, followed by chemical analysis. Measurements were taken at three-hour intervals. Conclusions were as follows: Air pollution diminishes with height. Sulfur dioxide levels were higher than soot levels; however, monthly averages for both pollutants were similar. Dispersion of the two pollutants was equivalent at the various altitudes. It was also noted that for ground level concentration, pollution was greatest at 9 a.m., probably because night fog prevents evacuation of the air, and least at 6 p.m. Above ground level, maximum concentrations were seen at noon and minimum concentrations at 3 p.m.

5582 APTIC NUMBER 15871

Bryant, Pamela M.
COMPUTED DEPOSITION RATES PER UNIT RELEASE RATE OF WINDBORNE MATERIAL. United Kingdom Atomic Energy Authority, Harwell, England, Authority Health and Safety Branch, Report AHSB(RP) R 40, 34p., Sept. 1965. 3 refs.

Methods of calculating strontium 90 and cesium 137 dry deposition rates, washout by rain, and combined (wet and dry) deposition rates are described with respect to unit rate of release to atmosphere. Computed values of these deposition rates corresponding to several alternative values of deposition velocity and of the washout coefficient over a range of stack heights and distances are in tabular form. The computer program, given in the appendix, includes calculation of derived working limits for continuous release rates of Sr90 and Cs137 to atmosphere in a milk producing area in Great Britain; these values are included. (Author abstract modified)

5583 APTIC NUMBER 18330

Clifton, R., M. B. Grimoldby, and A. J. Sharp
BLACK AREAS AND THE NATIONAL SURVEY OF SMOKE AND SULPHUR DIOXIDE. Proc. Harrogate Conf., Natl. Soc. Clean Air, London, England, 1968, 29p. 7 refs.

A statistical analysis was made of data from the National Survey of Smoke and Sulphur Dioxide for the most highly polluted sites in Great Britain during the six winters from Oct. 1961 to March 1967. The purpose of the study was to determine whether the so-called Black Areas really were 'black' and also whether there were other places not so designated which were heavily polluted. The National Survey data and the summary of analytical results are presented. Taking into account significant limitations in the data, preliminary results show that there was a dramatic decline in the severity of pollution, especially in the case of smoke, during the winters studied. For both smoke and sulfur dioxide, the worst year was 1962-63, during which severe pollution episodes occurred. During the earlier years studied, smoke concentrations were generally higher than those of SO2; by 1964-65 this situation was reversed in the winter averages. The general decline in pollution levels should be viewed cautiously, since over such a relatively short period of study it might be accounted for by weather factors. The distribution patterns of the sites studied are discussed in relation to region and immediate environment. Black Areas, so listed in 1960 as areas subject to an unduly high risk of serious pollution, showed up in the data with extreme variability. Although virtually all the localities represented in the groups of highest-pollution sites are in Black Areas, there are many Black Areas not represented at all, so that the term is considered to have very different implications in different parts of the country.

5584 APTIC NUMBER 18616

Commission on Earth, Water, and Air, Rotterdam
REPORT ON THE YEAR 1967. (Verslag over het jaar 1967). Text in Dutch. 129p.

The Commission on Earth, Water and Air Pollution, Rotterdam, is composed of engineers and scientists from various municipal commissions and public service departments. It works closely with other municipal groups and industrial associations to regulate pollution in the area around the mouth of the Rhine, collaborating

on guidelines for municipal ordinances and emission standards. The commission operates an extensive measurement network and maintains laboratory facilities for the chemical analysis of pollutants. One of its purposes is to compile a report of all public and private activities relating to combating the pollution of earth, water, and air. This report for 1967 surveys the reduction in pollution effected by measures undertaken by municipal power operations, municipal plants, and private industry in the Rotterdam area; control methods still under study; sources of water pollution; complaints about the dispersion of unpleasant odors, smoke, soot, and fog; the possible relation between air pollution and bronchitis in municipal employees and school children; results of atmospheric measurements; and the preparations for a national environmental hygiene literature pool. In 1967, pollution caused by smoke, sulfur dioxide, and polycyclic hydrocarbons continued to decrease, indicating that conditions imposed by authorities and efforts made by industries were largely successful. Measurement data and meter readings are tabulated. Maps of the measurement network are included.

5585 APTIC NUMBER 18833

DeWolf, J. B. and G. Fiocco
GEOPHYSICAL RESEARCH. A. EXPERIMENTS TO DETERMINE THE AEROSOL CONTENT OF AIR FROM SPECTRAL ANALYSIS OF LASER ECHOES. In: Quarterly Progress Report no. 87, Massachusetts Inst. of Tech., Cambridge, Research Lab. of Electronics, Contract NAS 12-836, QPR 87, Chapt. 5, p. 37-40, Oct. 15, 1967.
CFSTI:TID 28203

Preliminary experiments consisted of measuring the spectrum of light scattered from air in the laboratory containing natural aerosol particles, and air containing an artificially produced dense fog. The laser beam was passed through an aperture to limit the amount of fluorescence radiation emitted, and then passed through a synchronized attenuator. The collected light was collimated and then passed through a pressure-scanned Fabry-Perot interferometer. The size of the scanning aperture was matched to the focused image of the scattering volume. To allow for the possibility that the laser spectrum or instrumental response might change during the course of the measurements, a rotating wheel with portions of the surface cut away was placed at the center of the scattering volume, so that the telescope was presented at alternate count intervals with scattering from the medium and scattering from the flat wheel surface. Although the spectrum of light scattered from the wheel is useful for comparative purposes, it should not be assumed to be identical to the instrumental response. Analysis of the data indicates that the amounts of light scattered by dust and by air are approximately equal. It is hoped that information on aerosol size distribution may be obtained with improved resolution and the use of two laser frequencies.

5586 APTIC NUMBER 15726

Richmeier, J.
THE VARIATION OF THE NATURAL SMALL AND LARGE ION CONCENTRATION INDOORS. (Das Verhalten der natuerlichen Klein - und Grossionenkonzentration in geschlossenen Raeumen). Text in German. Intern. J. Biometeorol., 13(1):51-60, 1969. 20 refs.

The small and large ion concentration was measured in a normal room with open or closed windows, in a windowless room, and in a windowless metal shielded room. A particle counter and a dot recorder were used. In the first room, the large ion concentration was higher by an open window, fluctuating between 500 and 8000 l/cu m. It was at a maximum in the morning and afternoon, and subsided over the weekend. The maximum value coincided with the higher air pollution caused by the morning and afternoon traffic rush hours. The small ion concentration was higher by a closed window. In the windowless room, the small ion concentration was on the average somewhat higher than in the room with windows; the large ion concentration was lower. When the door of the room was open, the large ion concentration increased; the small ion concentration decreased. In the metal screened room, the small ion concentration was three times as large as in the open air. Opening the door for a longer period of time increased the large ion concentration.

5587 APTIC NUMBER 18785

Franco, P. and C. De Pompeis
INQUIRY INTO ATMOSPHERIC POLLUTION IN THE CITY OF PESCARA. (Indagine sull'inquinamento atmosferico nella citta' di Pescara). Text in Italian. Igiene Sanita Publica (Rome), 24(11-12):550-567, Nov.-Dec. 1968. 29 refs.

This Italian city of 120,000 inhabitants and 20,703 motor vehicles has light to medium industry, relies heavily on tourist trade from surrounding resorts, is the fastest-growing city outside Rome, and is intersected (rather than by-passed) by the Adriatic national highway. Homes are heated, mostly with heavy naphtha, from early November to late March. Fifty percent of approximately 1000 home heating plants lack official approval. No central facility for burning trash is provided. In May 1967 and April-June 1968, the air was tested at 15 critical points with Draeger 19/31 gas detectors, located 1-1.70 m above street level, for the presence of CO, CO2, SO2, hydrocarbons, and the nitrogen oxides, from 8:30 to 12 a.m. and 7-8 p.m. Carbon monoxide was detected at six points; at one point, where crosstown and Adriatic highway traffic meet, the concentration was 100 ppm. Sulfur dioxide was detected at two points. Practical proposals were made: better placement of bus stops, timed traffic lights, installation of air purifiers, possibility of more electrically driven public transport, education of motorists in 'anti-pollution' driving habits, and use of larger zones of vegetation in congested areas. The authors feel that confinement of Pescara's expansion to the seacoast has been salutary and they oppose future expansion into the hilly inland region, because such expansion would promote more severe air pollution problems.

5588 APTIC NUMBER 15826

Georgii, Hans-Walter
CHARACTERISTIC PARAMETERS AND EXTENT OF AIR POLLUTION.

(Kenngroessen und Ausmass der Luftverunreinigung). Text in German. Wasser Abwasser (Munich), 106(48):1216-1220, Nov. 1965. 9 refs.

In considering air pollution, one has to differentiate between dusts and gases. Dust concentration in clean air is about 0.01 to 0.02 mg/cu m; in polluted air, it may rise to 0.1 to 0.8 mg/cu m. Rapidly sedimenting large-grained dust is collected at 2715 measuring stations in North Rhine Westphalia in connection with the so-called statewide First Air Quality Measurement Program. In nonindustrial areas, a dust sedimentation of 0.42 g/sq m/day has been found; in industrial areas, sedimentation is 0.85 g/sq m/day. Similar dust sedimentation measurements in Frankfurt showed that the quantity of sedimenting dust depends on the season and on meteorological factors, primarily wind speed. Studies of vertical distribution of the dust showed that at 50 m above ground the dust concentration drops rapidly to about 0.3 g/sq m/day (in Frankfurt); at 60 m it drops to 0.1 g/sq m/day. A close connection exists between population density and the quantity of sedimenting dust. Of the gaseous pollutants, the most prominent as far as quantity and extent is concerned is SO2. In New York, 6000 tons of SO2 are thrown into the atmosphere daily; in London, 1400 tons per day. The atmospheric SO2 concentration in unpopulated areas is 0.01 to 0.02 mg/cu m; in large cities, it can rise to 2 mg/cu m. The atmospheric SO2 concentration depends not only on the number and strength of emission sources but also on weather conditions. Wind speed is of particular importance, as measurements by the Frankfurt Meteorological Institute showed. Another important factor is the temperature lapse rate. A negative lapse rate impairs vertical dispersion of pollutants and may lead to dangerous pollution concentrations, such as occurred in London in 1952 and North Rhine Westphalia in 1962. The latter incident led to the creation of a smog alert service. Motor vehicles are major contributors of gaseous pollutants. The CO content in the atmosphere is considered to be representative of the exhaust gas emissions of a city. Measurements in Cincinnati and Frankfurt are mentioned as examples.

5549 APTIC NUMBER 15212

Gibson, J. A. R., J. W. Richards, and J. Docherty
NUCLEAR RADIATION IN THE ENVIRONMENT - BETA AND GAMMA-RAY DOSE RATES AND AIR IONIZATION FROM 1951 TO 1968. J. Atmospheric Terrest. Phys., 31(9):1183-1196, Sept. 1969. 33 refs.

The dose rates and air ionization due to beta and gamma radiation were measured continuously over open grassland at Grove, Berkshire, England from 1961 to 1968. The measurements are compared to the dose rates calculated from the radioactivity deposited from nuclear weapon tests for the purpose of estimating dose rates back to 1951. These data are required for estimating possible biological effects on man and for studies of the electrical potential gradient in the atmosphere. Dose rates from natural sources were also considered and calculations and measurement of dose rates from cosmic rays, radioactivity in the soil and the air are included. The results from gamma radiation from fallout at 1 meter show a good correlation between measurement and calculation. The maximum dose rates occurred soon after the weapon tests of 1958, 1961, with levels up to 3.6 microrads/hr. The corresponding maximum levels for beta radiation at 1 meter were 80 microrads/hr. These levels must be modified to allow for attentuation by clothing before they can be applied to man, but the ionization of the atmosphere can be directly related to the potential gradient. The corresponding natural levels are 4.8 microrads/hr for cosmic rays, 3.7 microrads/hr for gamma radiation from air and soil, 1.8 microrads/hr for beta radiation, and 1.8 ion pairs/cc/sec for alpha radiation in air. The total natural ionization at Grove is 7.7 ion pairs/cc/sec. These calculations may be applied to other locations by allowing for the differences in the radioactive content of the ground and air, barometric pressure (cosmic radiation), latitude (cosmic radiation and fallout), and rainfall (fallout). (Author abstract modified)

5550 APTIC NUMBER 14484

Hamamura, M.
ON THE AIR POLLUTION OF MIZUSHIMA INDUSTRIAL AREA, OKAYAMA PREFECTURE. REPORT 6. (Okayama-ken Mizushima kogyo chitai no taiki osen. Dai 6 po). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):98, April 1969.

About 500 million tons/yr of steel and 220,000 barrels per day of oil are produced in the Mizushima area with an expected 300% increase in the future. This paper is a brief report of air pollution patterns in this area. According to sulfur dioxide measurements by the lead peroxide method, the maximum average value in 1965 was 0.5 mg/100 sq cm/day, but this value reached 1.4 mg/100 sq cm/day in 1968. In the summer, southerly winds from the sea during the day cause accumulation of pollutants north of the industrial area up to 0.9 mg/100 sq cm/day. Winter-type pollution appears when northwesterly winds blow from December through January.

5551 APTIC NUMBER 15897

Hamsie, K. and C. Schiller
HYGIENIC AIR INVESTIGATIONS IN THE HALLE DISTRICT: MEASUREMENTS OF SO2 EMISSION IN HALLE AND HALLE-NEUSTADT. (Lufthygienische Untersuchungen im Bezirk Halle. SO2-Immissionsmessungen in Halle und Halle-Neustadt). Text in German. Z. Ges. Hyg. (Berlin), 15(11):811-817, Nov. 1969. 10 refs.

Random sample measurements were made at 27 sites in Halle and 63 sites in Halle-Neustadt from 1966 to 1967 to detect local differences in SO2 emissions. Emission dimensionless groups were calculated from the measured values. These parameters clearly indicated the differences of exposure. The hygienically allowable concentrations exceeded the limit in the entire area in varied amounts. The local distribution of the emission dimensionless groups was illustrated on maps. (Author summary modified)

5552 APTIC NUMBER 18762

Heller, A. and H. Kettner
RESEARCH ON LEAD IN THE AIR AND IN DUST PRECIPITATIONS.

(Forschungsarbeiten ueber Blei in der Luft und in Staubniederschlaegen). Text in German. Schriftenreihe Ver. Wasser Boden Lufthyg. (Berlin), no. 29, 61p., 1969. 3 refs.

To determine the lead content in atmospheric air a total of 245 samples were taken in the cities of Muelheim (Ruhr Valley), Duesseldorf, Neuss and Rhine, Duisburg, and Wuppertal. Staplex high volume samplers were set up in busy streets and squares and samples were taken at 1 m above the pavement. One sampling station in each city was located in a quiet, traffic-free area; all used the discontinuous method with a sampling time of 1 hr. Glass fiber was used as filter material and analysis of the samples was performed by the dithizone method. The lead concentrations fluctuated between 0.5 and 12.5 micrograms/cu m; the median was 3.2. Weather conditions and size of roads and squares strongly influenced the lead content of the air. The control reference stations also showed considerable amounts of lead in the surrounding atmosphere. The dust content, which was also measured, was found to reach 1.72 mg/cu m at 1 m above ground. The lead content of the dust was generally below 1%. Comparison of the dithizone and the atomic absorption spectrophotometric methods showed that both are suitable for such analyses.

5554 APTIC NUMBER 14997

Hilst, Glenn R., John F. Yocom, and Norman P. Bowne
THE DEVELOPMENT OF A SIMULATION MODEL FOR AIR POLLUTION OVER CONNECTICUT. VOLUME 1. (SUMMARY REPORT.). Travelers Research Center, Inc., Hartford, Conn., Grant PHA-67-4, 66p., Oct. 1967. 4 refs.
CFSTI, DDC: PB 182 608

A working, computer-oriented simulation model of the state-wide Connecticut air pollution system was developed. This simulation model is designed to estimate the cumulative air pollution loading of Connecticut's atmosphere with a spatial resolution of one mile and a time resolution of one hour. Any arbitrary distribution of the air pollution sources can be evaluated with regard to resultant air quality over the region. As a management tool for evaluation of alternative air pollution control practices, this model provides an unprecedented information and evaluation system. In addition to the construction of this very versatile simulation model, an inventory of the location and hour-by-hour emission rates of the varied sources of five pollutants was completed, the major variabilities of the atmospheric dispersion processes over Connecticut were assessed. These products serve as the input variables to the simulation model. The source inventories show that, in 1967, man-made sources of air pollution in Connecticut will emit some 300,000 tons of oxides of sulfur, 129,000 tons of the oxides of nitrogen, 1,290,000 tons of carbon monoxide, 328,600 tons of hydrocarbons, and 63,900 tons of suspended particulates. Exemplary calculations of the expected air pollution levels in Connecticut under various meteorological conditions, as predicted by the simulation model, are presented. These examples show clearly the regional variability of air quality; they illustrate the power of the model to evaluate of complex planning and control problems inherent in effective air resource management. Connecticut will have the advantage of a system that can evaluate the air quality implications of control plans before they are implemented and also define, in unprecedented detail, the causes of present and future air pollution problems. (Author summary modified)

5558 APTIC NUMBER 18066

Bluchan, P., J. Mayer, and P. Abel
AMBIENT POLLUTION FROM FLUORINE COMPOUNDS IN THE NEIGHBORHOOD OF AN ALUMINUM FACTORY. (Inquinamento ambientale da composti del fluoro nelle vicinanze di una fabbrica di alluminio). Text in Italian. Med. Lavoro (Milan), 59(5):370-375, 1968.

Measurements conducted from 1958 to 1965 show that fluoride emissions from an aluminum factory near Bratislava ranged from 3.6 to 8.7 tons per day. In the zone surrounding the factory, the total concentration of fluoride in the air averaged 0.14 mg/cu m, five times the amount of the maximum allowable concentration. The gaseous fluorides HF and SiF_4 constituted 39% of the total fluorides in this area, and the particulate fluorides CaF_2, NaF, and AlF_3 about 61%. At a distance of about 8 to 9 km, the gaseous forms were 85% of the total, and the particulates only 15%. Values up to 135 mg F/100 g were found in the soil near the factory. Grass in this area had a fluorine content as high as 135 mg/100 g dry weight. Drinking water in the area was relatively unaffected, but the pollution of marsh and stagnant waters averaged 10.9 mg/liter. The high environmental F concentrations were reflected in animals: ashes from the bones of sparrows and frogs caught near the factory contained, respectively, from 101.3 to 352.7 and 85.2 to 788 mg/100 g. The following measures are proposed to protect the health of the inhabitants of the region: limitations on the food products grown even in the least contaminated zones and on the number of persons allowed to settle in the area, clinical control of the exposed population, and a plan of development for the entire region. These measures should be implemented by technological steps to reduce the pollution caused by the factory.

5555 APTIC NUMBER 15218

Hoffman, Gerald L., Robert A. Duce, and William H. Zoller
VANADIUM, COPPER, AND ALUMINUM IN THE LOWER ATMOSPHERE BETWEEN CALIFORNIA AND HAWAII. Environ. Sci. Technol., 3(11):1207-1210, Nov. 1969. 10 refs.

The transport of particulate matter from the North American continent over long distances was investigated. Atmospheric particulate samples were collected from a 20-meter-high tower on the windward coast of the island of Hawaii and from a ship between California and Hawaii. The particulate matter was collected on glass fiber filters using a high-volume pump. Particulate matter was removed by agitation of the filters in 100 ml of distilled demineralized water. The samples were analyzed for Na by flame photometry and for V, Cu, and Al by thermal neutron activation. The Na/Cu, Na/V, and Na/Al ratios for seawater were considerably greater than those for the particulate matter, indicating a

nonmarine source for Cu, V, and Al. Elemental ratios suggest that Al and V probably come from the weathering of continental crustal material. The source of the high Cu concentrations is unknown, although contributions from man-made pollution on the west coast of North America is a possibility.

5556 APTIC NUMBER 15286

Horn, K., A. Knauer, P. Liebscher, and K. Thorandt
ON THE QUESTION OF AIR POLLUTION BY LARGE SOFT COAL-FIRED POWER PLANTS. RESULTS OF YEAR LONG DUST FALL MEASUREMENTS IN THE AREA OF HIRSCHFELDE. (Zur Frage der Luftverunreinigung durch Grosskraftwerke auf Braunkohlenbasis. Ergebnisse einjaehriger Staubsedimentationsmessungen im Raum Hirschfelde). Text in German. Z. Ges. Hyg. (Berlin), 14(5):360-362, May 1968.

In the area of Hirschfelde, East Germany, where air pollution stems almost exclusively from two soft coal-fired power plants, dust fall measurements were taken at 10 stations over a period of one year. Glass containers (DIN standard 5073) with a collecting area of 63.6 sq cm were set up. The glasses were filled with distilled water and, in winter, with 100 ml glycerine as well. Exposure time generally extended over two weeks. The results show dust fall varies greatly with time and location, decreasing with increasing distance from the power plants. Computation of the frequency distribution of the 248 individual measurements yielded a logarithmic distribution. At the five stations with the highest dust fall, the average concentration was 725, 276, 143, 128, and 116 g/sq m per day.

5557 APTIC NUMBER 14795

Jacquemain, P., P. Remy, and M. C. Remy-Rillon
ATMOSPHERIC POLLUTION AT BESANCON DURING THE YEAR 1967. (La pollution atmospherique a Besancon durant l'annee 1967). Text in French. Pollut. Atmos. (Paris), 10(40):219-223, Oct.-Dec. 1968. 3 refs.

Smoke and sulfur dioxide levels were determined at six strategic locations in the center and around the outskirts of Besancon. The maximum sulfur dioxide level was 200-300 micrograms/cu m, and the minimum was 30 micrograms/cu m. As expected, the heaviest pollution was during the fall and winter months. The monthly averages were determined. For sulfur dioxide, these ranged from 60-130 micrograms/cu m, depending on the time of year. For smoke, the average monthly level was 87-189 micrograms/cu m. Pollution was heaviest in the center of the city near the railroad station. Precipitation had no effect on the monthly averages.

5558 APTIC NUMBER 15900

Fabl, W. and W. Muschter
MONITORING OF THE DUST AND SO2 LOADING OF ATMOSPHERIC AIR IN BERLIN BY MEASUREMENTS OF DAILY AVERAGES. (Ueberwachung der Staub- und SO2-Belastung der atmosphaerischen Luft in Berlin durch Tagesdurchschnittsmessungen). Text in German. Z. Ges. Hyg. (Berlin), 15(11):817-821, Nov. 1969. 19 refs.

Daily average concentrations of dust and sulfur dioxide were measured on working days at 10 sites in Berlin from April 1969 to March 1969. The establishment of measuring stations and measurement methods were described. The local and time concentration distributions and percentage exceeding frequency rates were discussed. Pollution concentration decreased from the city center to the surburban areas. The time processes showed great differences between the non-heating period and the heating period, particularly with SO2 concentrations. Generally, dust concentrations were double the sulfur dioxide concentrations. (Author summary modified)

5559 APTIC NUMBER 14868

Kharitonova, S. S.
DUSTINESS OF THE AIR DURING DUST STORMS ON THE MANGYSHLAK PENINSULA. (Zapylennost' vozdukha vo vremya pyl'nykh bur' na poluostrove Mangyshlak). Text in Russian. Meteorol. i Gidrol., no. 5:87-88, May 1969. 4 refs.

Values were determined for the dustiness of the air in a 20-meter layer above the ground. Measurements were made by aspirators mounted on masts. There were 26 to 47 dust storms per year in the 5 years during which observations were made. They occurred particularly in the summer and early fall months when the wind exceeded 6-7 m/sec; the average duration of such storms was 3-4 hrs. In the spring, the air at a height of 3 m contained an average of 27 g/cu m of dust, in the summer 40 mg/cu m, and in the fall 20 mg/cu m, although it varied within wide limits. The highest value for dust content was 245 mg/cu m, and the lowest 1.5 mg/cu m. Dustiness decreased rapidly with height.

5560 APTIC NUMBER 15348

Kolar, Joergen
STUDIES OF THE DISPERSION OF SULFUR DIOXIDE IN DENSELY OCCUPIED CITY AREAS WITH SPECIAL REGARD TO EMISSION FROM LOW SOURCES. (Untersuchungen ueber die Ausbreitung von Schwefeldioxid in dicht bebauten Stadtgebieten unter besonderer Beruecksichtigung der Emission aus niedrigen Quellhoehen). Text in German. Energie (Munich), 21(9):269-78, Sept. 1969. 28 refs.

To collect information on dispersion in densely populated areas, sulfur dioxide concentrations were measured in the stack and in the ambient atmosphere of a steam plant in central Munich. During the measurement period, Bavarian coal with 5% sulfur, as well as Saar coal or fuel oil, was burned. The flue gas volume and the SO2 concentration were measured 11 m beyond the exhaust blower. A quartz glass probe was used for sampling the flue gas. The analysis was performed with an electroconductivity analyzer. The sulfur dioxide immission was measured with a mobile electroconductivity analyzer. Measurements were taken between 10 a.m. and 5 p.m. The measurement points were selected in

accordance with the prevailing conditions, i.e., with the wind coming from a constant direction at velocities of more than 2m/sec. The measurement program began in February 1962, but the most intensive investigations were carried out in the winter of 1965/66, with half hour measuring periods on the lee of the stack. A nearly log normal distribution of the SO2 immissions in the city area was found. The influence of interfering emissions and of the variation of the sulfur dioxide immission (mean standard deviation of 0.1 mg/cu m) are briefly evaluated. Preliminary measurement results are tabulated and shown in a diagram. The highest immission measured did not exceed the maximum allowable concentration of 5 mg/cu m.

5561 APTIC NUMBER 15154

Lahmann, Erdwin and Siegfried Haentzsch
AIR POLLUTION BY HYDROCARBONS. (Luftverunreinigung durch Kohlenwasserstoffe). Text in German. Staedtehygiene (Melzen/Hamburg), 20(10):243-246, 1969. 15 refs.

At the side of a busy road in Berlin, automatic air quality measurements (mainly of hydrocarbons) were taken for a total of six months between 1967 and 1968 using the Beckman hydrocarbon analyzer 109 A. The air samples were taken at 75 cm above the pavement. The measurements were made mostly from 6 a.m. to 10 p.m. and a total of 3500 half-hourly values were obtained. It was found that 75% of the individual values belonged to the concentration range of 3 to 7 ppm hydrocarbons (methane equivalents) and 1.5% of the values exceeded 10 ppm. The arithmetic mean of all values was 5.0 ppm, the 50% value of the cumulative frequency was 4.5 ppm, the 95% value of the cumulative frequency was 8.8 ppm, and the 98% value of the cumulative frequency was 9.8 ppm. The three highest concentrations measured were 17.2, 15.9, and 15.3 ppm. The highest hydrocarbon concentrations were measured during traffic rush hours in the morning and afternoon. The measured concentrations are not considered to be dangerous. In 1955, the maximum allowable concentration for gasoline was set at 500 ppm. The maximum allowable atmospheric concentration is 20 ppm (long-term) and 60 ppm (short-term). A table of hydrocarbon concentrations found in several American cities between 1962 and 1966 is included.

5562 APTIC NUMBER 15557

Lahmann, Erdwin, Juergen Westphal, Kurt Damaschke, and Margot Luebke
CONTINUOUS OZONE MEASUREMENTS IN A HEAVILY TRAVELLED STREET. (Kontinuierliche Ozon-Messungen in einer verkehrsreichen Strasse). Text in German. Gesundh. Ingr., 89(5):144-147, 1968. 12 refs.

At two measuring stations in Berlin, continuous ozone measurements were taken from the summer of 1966 to the summer of 1967. The first measuring station was located on a busy street in Berlin Steglitz. The air samples were taken at 20 m and sometimes also at 2 m. The second station was in a quiet area without traffic; the samples were taken at 10 m. The results show that in the busy Schlosstrasse, maximum ozone concentration was about 5 pphm. Of the total number of individual measurements, 8.6% exceeded 1 pphm and only 2% exceeded 2 pphm. The maximum daily average was 3.2 pphm. Higher ozone concentrations were measured in summer than in winter. The average ozone concentrations in the traffic-free area were much higher than those in the busy street. Comparison of the diurnal variations of ozone concentration at the two stations clearly shows the influence of traffic. In the traffic-free area, the ozone concentration rises from a minimum between 5 and 6 a.m. to a maximum between 2 and 3 p.m. and gradually subsides again. In the busy Schlosstrasse, the ozone concentration drops to a minimum between 7 and 8 a.m. At this time, which coincides with the morning rush hour, the ozone concentration was just half as high as that in the traffic-free area.

5563 APTIC NUMBER 18776

Lahmann, Erdwin
STUDIES OF AIR POLLUTION CAUSED BY MOTOR VEHICLES. (Untersuchungen ueber Luftverunreinigungen durch den Kraftverkehr). Text in German. Schriftenreihe Ver. Wasser Boden Lufthyg. (Berlin), no. 28, 80p., 1969. 123 refs.

A measuring station for determining the extent of air pollution caused by motor vehicles was erected in front of the city hall in West Berlin, considered to be the busiest point in the city. The Uras infrared analyzer was used for continuous measurement of CO and CO2 concentrations 75 cm above the ground; ozone was continuously measured at 2 and 20 m with a unit developed by Damaschke und Luebke based on liberation of bromine from a potassium bromide solution by ozone. For continuous measurement of hydrocarbons at 75 cm, a Beckman 109A analyzer was used. Discontinuous sampling was employed for measurement of NO, SO2, formaldehyde, and phenols. A high volume sampler was used for determination of the total dust concentration. Traffic counts were conducted throughout the measurement period, and the driving cycles were determined. The results are listed in detail in numerous tables and diagrams. The influence of meteorological factors such as wind direction and speed, humidity, temperature, and pressure is discussed. The maximum half-hourly average CO concentration was 60 ppm with concentration peaks in the morning and afternoon rush hours. Maximum CO2 concentration was somewhat less than 500 ppm and thus only 50% higher than the natural CO2 concentration of the atmosphere. No dangerous ozone concentrations were measured. All NO2 concentrations were below 0.2 mg/cu m. Peak SO2 concentrations occurred in between rush hours, which indicates that they are due to domestic heaters. A linear relationship between the various pollutants was found. The results of these measurements are compared with results in the literature.

5564 APTIC NUMBER 15575

Lehmann, P. and J. Westphal
RELATIONSHIP BETWEEN MOTOR TRAFFIC DENSITY AND AIR POLLUTION IN A METROPOLITAN STREET. (Beziehungen zwischen Kraftverkehrsdichte und Luftverunreinigungen in einer Grossstadtstrasse). Text in German. Strassenbau (Duesseldorf-Oberkassel), no. 6: 8p., 1968. 8 refs.

In the years 1966 and 1967, extensive air quality measurements were made on a busy street in Berlin. The relationships between the traffic density and the carbon monoxide, hydrocarbons and lead concentrations in the air above the street were determined. The CO was continuously measured with an infrared analyzer over a period of 12 months. The air samples were taken 75 cm above the pavement. Half-hourly averages were obtained from the continuously recorded CO concentrations. The hydrocarbon (CH) concentration was continuously measured with a flame ionization detector. The lead content was determined intermittently at a height of 3 m. Analysis of the precipitated dust for leadwas performed by the dithizon method. Simultaneously with the lead concentration measurements, traffic counts were conducted between 6 a.m. and 8 p.m. The correlation coefficients were determined for the relationship between traffic density and the CO, CH and lead concentrations. These were 0.90, 0.85, and 0.78, respectively. A correlation between the CO, CH, and lead content of the air and the traffic density was found when long-term averages were used for the comparison. Comparison of the measured results of just one day showed no correlation. The meteorological influence was stronger in this case than that of the traffic density. Concentrations of the various exhaust components were generally interdependent. In this way, measurement of just one substance is sufficient to obtain general information on air composition.

5565 APTIC NUMBER 13838

Macuch, P., P. Bluchan, J. Mayer, and P. Able
AIR POLLUTION BY FLUORIDE COMPOUNDS NEAR AN ALUMINUM FACTORY.
Fluoride Quarterly, J. Intern. Soc. Fluoride Res., 2(1):29-32, Jan. 1969.

From 1958 to 1965, contamination near an aluminum factory in the vicinity of Bratislava, Czechoslovakia, averaged 0.18 mg F/cu cm. This average represents a fivefold increase above the maximum allowable concentration of 0.03 mg F/cu cm. The gaseous fluorides HF and SiF_4 constitute 39% of the fluid values in the air near the plant as compared to 61% solids, namely CaF_2, NaF, and AlF_3. The proportion varies with the distance from the factory: at an area 8 to 9 km from the factory, 15% solid and 85% gaseous F compounds were present in the atmosphere. The relative increase in gaseous compounds is apparently due to sedimentation of the solid F compounds near the factory. Values of the yearly F fallout in the contaminated area were 88 to 7337 kg sq km. F values obtained for soil in the area of the factory were 135 mg/100 g (1350). This is 4 to 7 times higher than the usual F content of soil. Grass near the factory contained F values as high as 133 mg/100 g dry substances. While running surface waters showed only slightly increased F levels, standing surface waters contained as much as 10.9 mg/l. Determination of F fallout and of F content in plants and biological materials is the best means of assessing long term effects of fluoride emissions. Meteorological influences appear to be less significant in evaluating F damage. The composition of soil, the presence of F dust on plants, and the F content of flowing and ground waters are of little use in determining F damage to human, plant, and animal life.

5566 APTIC NUMBER 15228

Materna, J., J. Jirgle, and J. Kucera
RESULTS OF THE MEASUREMENT OF SULFUR DIOXIDE CONCENTRATIONS IN THE WOODS OF ORE MOUNTAINS. (Vysledky mereni koncentraci kyslicniku siriciteho v lesich Krusnych hor). Text in Czech. Ochrana Ovzdusi, 1(6):88-92, 1969. 5 refs.

The concentration of sulfur dioxide was measured on different days to compare the level of emissions with the state of the woods and to observe the changes in concentration levels as a result of new emission sources. Emissions considered were SO2 levels above 0.01 mg/cu m. Measurements were taken with polarographic - coulometric analyzers beginning in 1966 in five regions which ranged from undamaged to heavily damaged fir copses. Measurements were taken at 30 minute intervals for one year. During measurement, the influence of emissions from a new thermal plant was seen on undamaged copses as the conditions grew worse. The results proved that there is a relationship between the damage of the copse and the emission level. It was verified that fir copses are damaged by lower sulfur dioxide concentrations than expected. To express all the factors that are influential in damaging plants, measurements based on an analysis of air samples abstracted during a longer time period are necessary.

5567 APTIC NUMBER 14930

Nakano, Michio
AIR MONITORING NETWORKS IN THE CITY, ITS SITUATION AND PROBLEMS (I). (Toshi taikiosen monitaringu netto waku. Sono genjo to mondaiten (I)). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):29-33, June 1969. 6 refs.

Eleven stations in Osaka city and six stations in Sakai city were established to collect air pollution data in a composite network system. Placement areas were chosen based on population density in the compact industrialized sections. Each station measures sulfur oxide gas by conductivity and floating dusts by digital meter, as well as wind direction and velocity. These data are sent to the central station every twenty minutes. With these facilities and equipment, industrial pollution is monitored by computer. Receiving offices in factories record and respond to the same data, taking prompt action in the case of hazardous pollution levels. In addition, mobile observation cars travel around the cities recording nitrogen oxide and carbon monoxide levels. Similar air monitoring networks are being developed in other cities.

5568 APTIC NUMBER 15610

Odaira, Toshio
AIR POLLUTION FROM MOTOR VEHICLE GASES IN TOKYO AND OSAKA.

(Dai toshi ni okeru jidosha haiki gas ni yoru taiki osen no jittai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(5):337-353, 1969. 17 refs.

Various pollutant concentrations were determined near highways and surrounding areas in Tokyo and Osaka. A large amount of carbon monoxide was found near the highways, and gradually decreased in the surrounding areas. The difference in the height of the pollutant between the highway and surrounding areas could not be measured to 100 m if the wind was slow and natural convections occurred. The carbon monoxide concentration was found to be related to traffic density. The four pollutant patterns differed from each other in the dust content, sulfur dioxide and nitrogen dioxide content, carbon monoxide and nitric oxide content, and ozone content. The average CO was 3 to 8 ppm/hr; however, 40 to 50 ppm/hr was not rare. In the middle of the city, over 10 ppm/hr was measured 27% of the time. In the districts that were 100 to 200 yards from the highway, the monthly average was 5 to 6 ppm, but 30 to 50 ppm/hr sometimes occurred. In winter, this became serious. Nitric oxide concentrations were 0.05 to 0.25 ppm along the highway; NO2 was estimated to be less than 0.05 ppm. For the surrounding districts, NO was 0.05 to 0.15 ppm in winter and 0.01 to 0.05 ppm in summer. Hydrocarbons averaged 2 ppm/mo along the highway. Carbon monoxide, NO, and the hydrocarbon concentration curve changed during the day. Oxidants averaged 0.02 to 0.06 ppm/mo and sometimes 0.14 to 0.25 ppm/hr. These measurements reveal that photochemical smog is important in Tokyo. Lead was 3 to 9 mg/cu m along the highway and 0.7 to 5 mg/cu m in the surrounding districts.

5569 APTIC NUMBER 15288

Bailer, H., H. Beguttner, P. Baumann, and J. A. Schedling
BENZO(A)PYRENE CONTENT OF DUST SAMPLES FROM THE METROPOLITAN AREA OF VIENNA. (Benzo(a)pyrengehalt von Staubproben aus dem Wiener Stadtgebiet). Text in German. Oesterr. Chemiker-Zeit., 67(6):222-5, July 1966. 15 refs.

To determine the benzo(a)pyrene content of 31 random dust samples collected on glass fiber filters in Vienna, the filters were extracted with benzene, the benzo(a)pyrene was separated with thin-layer chromatography, and the concentration was determined by spectrophotometry. The samples were obtained from January 1965 to October 1965. In warm weather, concentrations between 16 and 70 micrograms/1000 cu m were measured. In winter months, the concentrations were much higher (123 to 165 micrograms/1000 cu m). Concentration measurements outside the city in the summer yielded values between 0.5 and 0.8 micrograms/1000 cu m. No relationship could be found between the dust concentration and the benzo(a)pyrene concentration. Comparison of the results with those of other cities shows good agreement. Inhaling 20 cu m of city air (100 micrograms benzo(a)pyrene/1000 cu m daily is shown to be equivalent to inhaling smoke from 50 to 60 cigarettes (0.03 micrograms benzo(a)pyrene).

5570 APTIC NUMBER 13715

Podlaha, M.
ON THE AIR POLLUTION IN THE NORTHERN BOHEMIA. III. (K znecisteni ovzdusi v severnich cechach. III.). Text in Czech. Cesk. Hyg. (Prague), 13(2):80-83, 1968. 1 ref.

Previous parts of the paper reported, on the basis of statistical analysis, the changes in probability fields describing air pollution in the towns of Most and Teplice, Czechoslovakia, and their surroundings from March 1965 to February 1966. The percent of times during which the mean concentration of sulfur dioxide exceeded 0.15 mg/cu m and those during which it exceeded 0.30 mg/cu m were calculated on the basis of probability data. The dependence of fluctuations of air pollutions on the seasons is shown. While air pollution is somewhat lower during the summer (Most 26%; Teplice 64%), it reaches critical levels in other seasons (Most in winter 98%, Teplice in spring 88% and in autumn 93%). Winter sulfur dioxide concentrations in Most exceeded the value of 0.30 mg/cu m in more than -% of the measurement periods. (Author summary modified)

5571 APTIC NUMBER 15288

Polgar, Ivan
RESULTS OF SYSTEMATIC SO2 MEASUREMENTS PERFORMED AT CERTAIN BUDAPEST LOCATIONS. (Budapest egyes pontjain vegzett rendszeres kendioxid-meresek eredmenyei). Text in Hungarian. Energia Atomtech. (Budapest), 21(7):388-395, 1968. 14 refs.

The influence of the weather on SO2 concentration in the air of Budapest was investigated on the basis of 900 measurements performed at 23 observation points (3-6 measurements/month/location) during the course of 11 months. The locations were selected so as to be uninfluenced by individual pollution sources (except for two observation posts near railroad stations). The objective of the study was to learn how instantaneous SO2 concentrations at different city locations, observed at different times, can be compared. Using the method of West and Gaeke, the minimum SO2 concentration that could be observed, was 0.05 mg/cu m in the winter and 0.025 mg/cu m in the summer. The Budapest 'health norm' is currently 0.20 mg/cu m. The air samples were taken 1.5 m above the ground between 9 a.m. and 8 p.m. Using standard statistical methods to eliminate the important influence of the winter daily average temperature, a linear dependence of SO2 concentration on percent cloud cover was found during the heating season. Below 4 m/sec, wind velocity was of little importance, but wind direction was found to be very important. Influence of precipitation was ambiguous. In the summer, the cloud cover and the wind direction are most important.

5572 APTIC NUMBER 14882

Pokushika, T., M. Aoyama, and Y. Murai
SEASONAL AIR POLLUTION IN HEIGHT AT A TALL APARTMENT HOUSE. (Koso apart no taiso betsu, kisetsu betsu taiki osen jokyo). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):97, April 1969.

Average temperature, sulfur oxides, dust fall, ammonia, and chloride ion were measured at the second, third (7.7 m), sixth (15.6 m), ninth (23.6 m), twelfth (31.5 m), and fifteenth (40 m) floors at a 15-story apartment building in Nagoya. Sulfur oxides were determined by the lead peroxide method. For the last three pollutants, samples were obtained by hanging white cotton cloths under the eaves for 30 days. After exposure, dust fall was determined by reflectance, and ammonia and chloride ion were determined by analysis of the distilled water used to wash the cloth. Average temperature tended to be higher at the 15th floor in any season. Sulfur oxides were most concentrated at the 2nd floor (0.68-0.73 mg/100 sq cm/day) and were highest in winter and fall. Dust fall was greatest in winter on the 9th floor level. Ammonia was highest in the summer, 1.57 mg/30 days/400 sq cm. Chloride ion was also most concentrated in summer (2.27 mg/30 days/400 sq m). Air pollutants were generally more concentrated at the middle floors of the apartment building.

5573 APTIC NUMBER 15658

Schuschke, G. and H. -D. Schulze
ERFAHRUNGEN MIT EINER ZWEI-JAHRE MESSUNG DER SCHWEFELDIOXID IMMISSION IN MAGDEBURG. (Erfahrungen bei der 2 Jaehrigen Messung der Schwefeldioxid-Immission in Magdeburg). Text in German. Z. Ges. Hyg. (Berlin), 15(7):510-515, July 1969. 21 refs.

For a period of two years, the atmospheric sulfur dioxide concentration in Magdeburg was measured at three stationary units and at 17 points reached by a mobile unit. For the mobile unit measurements, an improvised apparatus was used, comprising a 12 V secondary battery, a horn without sound, and a volume and flow meter. The samples were obtained 1.5 m above ground; sampling time was 10 min, and the air throughput was 15 l. At the stationary units, the air throughput was 860 l/24 hrs. The SO2 was analyzed by the West and Gaeke method after total of 14,000 measurements were taken. The overall average of the 10 min measurements between 7 a.m. and 4 p.m. ranged from 0.27 mg SO2/cu m to 1.00 mg SO2/cu m in the cold season and from 0.11 mg SO2/cu m to 0.28 mg SO2/cu m in the warm season. In the former case, the maximum allowable short-term concentration of 0.5 mg SO2/cu m was exceeded by 18 to 70%; in the latter case, by 1 to 15%. The overall averages of the mean 24-hour concentration ranged in the cold season from 0.07 mg SO2/cu m to 0.28 mg SO2/cu m and in the warm season, from 0.03 mg SO2/cu m to 0.10 mg SO2/cu m. The maximum allowable long-term concentration of 0.15 mg SO2/cu m was exceeded in the cold season by a frequency of 8% to 88%, and in the warm season by 1% to 10%.

5574 APTIC NUMBER 15780

Stewart, W. S. and D. H. Wilken
EFFECT OF SHADE ON ATMOSPHERIC OXIDANTS (SMOG). Preprint, 11p., 1966?. 10 refs.

Experiments were conducted to compare simultaneously smog oxidant level in sunlight and under shade. In one series of experiments, air samples taken from a cardboard box and a glass jar were compared to those taken outside the shade chambers. In other experiments, samples were taken simultaneously from the glass chamber and from under the leaf canopy of a Bougainvillea vine or Albizzia julibrissen tree. In comparison to sunlight, oxidant reduction occurred in all samples taken from shade chambers and was also observed in the shade under plant canopy. The highest reduction was observed in the cardboard box, presumably because of its greater volume. Observed differences in the oxidant level between sun and shade were relatively unaffected by temperature, but presumably affected by breezes and air movement. The data suggest that undesirable effects of smog on vegetation can be reduced by the planting of shade trees, vines, and shrubs or by the use of patios and trellises. This concept of shading to reduce smog level might also be applied to parking lots and recreation areas.

5575 APTIC NUMBER 14679

Tanimura, Misashige
STUDY ON THE RELATION BETWEEN BENZO(A)PYRENE OF THE SUSPENDED MATTERS AND THAT OF THE FALLING MATTERS IN THE ATMOSPHERE. (Taikichu no fuyujin to rakkajin chu no Benzo (a) pyrene ryo no kankei ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), vol. 21:269-278, 1966. 31 refs.

Suspended and settling particulates were collected in industrial and residential urban districts in the city of Kita-Kyushu in the summer and winter from 1960-1965 and analyzed for benzopyrene. Suspended and settling particulates were collected at similar times and places and the relationship between benzopyrene in suspended particulates and settling particulates was determined. The results showed a high correlation between benzopyrene in suspended and settling particulates in both seasons and in similar places. In suspended and settling particulates, benzopyrene in industrial urban areas was greater in the winter and was always greater than in residential areas. (Author abstract modified)

5576 APTIC NUMBER 15162

Terabe, Motoji and Masanobu Nagata
COMPARATIVE STUDY ON MEASUREMENTS OF SUSPENDED PARTICULATE MATTER USING THE FOUR KINDS OF SAMPLERS. (Taikichu fuyubaijin sokuteiho no hikaku kenkyu). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(3):9-15, Oct. 1969. 12 refs.

Results of sampling tests conducted with a high-volume sampler, a cyclone high-volume sampler, a tape sampler, and a digital dust indicator on the roof of the Kawasaki Hygienic Laboratory from July 1968 to January 1969 are presented. The cyclone hi-vol sampler was used to collect dusts of over 3.3 microns. Dusts below 3.3 microns were concentrated by the fiber glass filter of the hi-vol sampler. The soiling index was recorded every hour by the tape sampler, and was calculated by the formula Cohs/1000 ft equals O.D. times 100/L, where O.D. (Optical Density) is log To/T, and To is the permeability of

filter paper to light before collecting dust and I is the permeability of the dust spot on the filter paper. Hourly numerical values of the atmospheric particulate matter were printed automatically by the digital dust indicator, and its average over 24 hrs was designated as CPH. Numerical values obtained by each sampler were presented in terms of respirable dust, soiling index, and CPH. Relationships between each numerical value and its comparative ratios were examined as follows: (i) respirable total dust, (ii) total dust soiling index, (iii) digital(CPH)/total dust, and (iv) digital (micrograms/cu m)/digital(CPH). Each one of these was discussed, and the ratio (ii) was comparable with the result obtained by another author. The soiling index was shown to be valuable as an indicator of atmospheric particulate matter. The relationship between total dust and season showed averages of 252 micrograms/cu m in summer, 282 micrograms/cu m in fall, and 331 micrograms/cu m in winter.

5577 APTIC NUMBER 15173

Tonomura, Masaharu, Nobuo Yamate, and Kusuo Tsuji
OBSERVATIONS OF AIR POLLUTION WITH THE AID OF AUTOMATIC CONTINUOUS ANALYSERS. IV. RELATIONSHIP AMONG THE CONCENTRATIONS OF VARIOUS KINDS OF POLLUTANTS IN ATMOSPHERE. (Benzoku sokutei kirokukei ni yoru taiki osen no kenkyu (dai 2 ho) Taikichu ni okeru osenbutsu kan no sokan kankei ni tsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 85:35-40, 1967. 8 refs.

In a study conducted from January through December in 1966, air pollution in Tokyo was determined. The relationships between the concentrations of various kinds of pollutants, such as CO, SO2, NO, NO2, and dust particles, were determined as a function of their concentrations in the air. The pollutants were collected in three heavy traffic areas in Tokyo: Kasumigaseki, Itabashi, and Shinjuku. A previous survey indicated that a relationship might exist among the atmospheric contaminants originating from automotive exhaust gases. To evaluate this possibility, correlation coefficients between the concentrations of CO-SO2 and CO-NO were calculated using data from the automatic and continuous analyzers. The correlation coefficients revealed that a nearly perfect linear relationship exists between both sets of contaminants. For CO-NO2 and SO2-NO2, no significant relationships could be obtained. It was concluded that formulas could be used to estimate the concentrations of some pollutants, primarily those originating from automotive exhaust gases. (Author abstract modified)

5578 APTIC NUMBER 15683

Umland, Fritz
PHYSICAL TESTING AND CHEMICAL ANALYSIS OF COMBUSTION AIR AND BLAST FURNACE GAS DUSTS TO DETERMINE THEIR INFLUENCE ON GAS TURBINES. PART II: EFFECT OF PARTICLE SIZE ON DUST CONCENTRATION. (Physikalische und chemische Untersuchung von Brennluft-und Gichtgasstaeuben bei Gasturbinen. Teil II. Abhaengigkeit der Staubzusammensetzung von der Korngroesse). Text in German. Motortech. Z. (Stuttgart), 30(11):407-411, Nov. 1969. 5 refs.

Dust samples were obtained at five measuring stations in three metallurgical plants. Corrosive substances are mainly found in the finest grains. In the plant having the lowest corrosion deposit on the turbine blades, the slag was not molten at the prevailing operating temperature. In another plant, where no surface protection coating or additive was used, the corrosion was extremely high and the slag was slightly liquid due to high concentrations of K2O and ZnO. In the third plant, the slag was medium liquid and the corrosion relatively high. It was accompanied by erosion resulting from coarse-grained dust fractions. The dust samples of the combustion air collected over a longer period of time show differences but not enough to explain the different degrees of corrosion. Great influence thus is attributed to the dusts in the waste gas. The plant with the least corrosion had the most effective gas cleaning system.

5579 APTIC NUMBER 15005

Weatherley, M.-L. P. M.
AIR POLLUTION MEASUREMENTS AT ISLINGTON, LONDON, IN 1966. PART II. GASEOUS POLLUTANTS SAMPLED INTERMITTENTLY: NITROGEN OXIDES, CARBON MONOXIDE, AMMONIA, AND SULFUR DIOXIDE MEASURED BY THE THORIN METHOD. Preprint, Warren Spring Lab., Stevenage, U. K., Atmospheric Pollution Div., LR 80(AP), 19p., Aug. 1966. 10 refs.

Concentrations of carbon monoxide, nitrogen oxides, and gaseous ammonia measured intermittently at Islington, London in 1966 were analysed for the frequency distribution of concentrations and correlations between pollutants. Estimates of sulfur dioxide from measurement of total sulfate and of net acidity, corrected for ammonia, are compared. Attention is drawn to the fact that the NO/NO2 ratio rises with NO concentration at levels normally found at Islington and that the rate of increase appears to decrease as smog levels are reached. The ratio is correlated with NO rather than NO2. It is suggested that low concentrations of nitric oxide are completely oxidized by ozone and that the proportion of NO oxidized decreases as the concentration rises and the ozone is used. The higher correlation between nitrogen oxides and sulfur dioxide compared with that of smoke suggests that nitrogen oxides at Islington arise mainly from nondomestic combustion. The presence of ammonia was not a major source of error in sulfur dioxide determination by the peroxide method, suggesting that the method is adequate for sulfur dioxide surveys. The borate net acidity method of measurement usually gave slightly higher concentrations than the thorin total sulfate method, suggesting that the borate method may be taking account of acid or acid-producing gases in the air not measured by the thorin method. On a few occasions the net acidity method gave very much lower concentrations than the thorin method, even after correction for ammonia. Differences between the two methods are more or less independent of concentration. (Author conclusions modified)

5580 APTIC NUMBER 15175

Yamate, Noboru and Toshiro Matsumura
LEAD CONTAMINATIONS OF AIR ON STREET IN ELEVEN MAJOR CITIES IN JAPAN (JULY-NOVEMBER, 1967). (Wagakuni 11 toshi no gairo taiki no namari osen ni tsuite (1967 nen 7 gatsu - 11 gatsu). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 86:189-190, 1968. 1 ref.

Lead concentrations of air were determined at crossings and roadsides in eleven major cities in Japan (Yokohama, Sendai, Aomori, Niigata, Kanazawa, Fukuoka, Kagoshima, Osaka, Kyoto, Nagoya, and Tokyo) from July to November, 1967. The average values of the lead concentrations during the daytime were between 1.70 and 13.58 micrograms/cu m. These values were higher than those obtained from July to October, 1966. (Author abstract modified)

5581 APTIC NUMBER 15310

Yamate, Noboru, Tosiro Matsumura, and Masaharu Tonomura
LEAD CONTAMINATION OF AIR ON STREET IN ELEVEN MAJOR CITIES IN JAPAN. (Wagakuni 11 toshi no gairo taiki no namari osen ni tsuite). Text in Japanese. Eisei Shikensho Hokoku (Bull. Natl. Inst. Hyg. Sci., Tokyo), no. 85:158-160, 1967. 4 refs.

Lead concentrations in the atmosphere on crossings and roadsides in eleven major cities in Japan (Sendai, Aomori, Niigata, Kanazawa, Fukuoka, Kagoshima, Osaka, Kyoto, Yokkaichi, Nagoya, and Tokyo) were determined. The lead compounds were collected with fiberglass filters (Gelman type A) and polarographically analyzed. Lead concentration in the daytime was between 0.78 and 11.17 micrograms/cu m. The lead concentration at route 20 in Tokyo was the highest, and at Sasashima in Nagoya and Yayoikan in Yokkaichi, the values were the lowest. The lead concentration was influenced by traffic density, traffic stagnation, and road conditions, and meteorological and geographical conditions. (Author abstract modified)

5582 APTIC NUMBER 15161

Yamate, Noboru
SUMMARY OF AIR POLLUTANTS LEVELS IN THREE AIR MONITORING STATIONS IN TOKYO, 1968. (Tokyotonai 3 chiten no taikiosen sokuteimo sokutei kekka no gaiyo). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(3):45-61, Oct. 1969.

Outlines of numerous figures, charts, and indices obtained by the air monitoring stations at three locations in Tokyo from January to December of 1968 are reported. The purpose of these monitoring activities was to determine exact and accurate pollutant levels in conjunction with traffic situations at the three monitoring station points. Measurements were made of seven pollutants using an autoratic recorder. The tested pollutants were SO2, carbon monoxide, NO, NO2, dusts, formaldehyde, and total oxides; traffic situation was recorded simultaneously. The average values measured were classified into hourly, daily, monthly, and yearly rates, and each maximum and minimum rate was reported. The relationship between traffic status and pollutant levels was obtained by the regression expression method. The quantities of CO, SO2, and HCHO showed the existence of a relationship, but NO2 and atmospheric dust did not show a particular relationship. The interrelationship between each pollutant level is reported and summarized. The general tendency of the pollutant levels determined for the past five years showed that both carbon monoxide and atmospheric dust were increasing, while nitrogen oxides remained almost the same and SO2 decreased.

5583 APTIC NUMBER 15287

Zur Muehlen, Thorkill
MEASUREMENTS OF STYRENE EMISSIONS AND IMMISSIONS WITH THE AID OF GAS CHROMATOGRAPHY. (Messungen von Styrol-Emissionen und -Immissionen mit Hilfe der Gaschromatographie). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, vol. 18:41-43, Feb. 1968. 15 refs.

Air samples for determining the concentration of styrene fumes in the vicinity of a processing plant for polyester resin were obtained with a gas collecting tube. A membrane pump was used to draw in 30 l air within a period of 5 minutes. In the gas chromatographic analysis of the samples; helium (99.99%) was used as a carrier gas and the operating temperature was 150 C. Calibration was performed according to the method described by J. May. At the outlet of the vapors, 340 ppm were measured; at a distance of 1 m, 130 ppm, at a distance of 10 m, 8 to 9 ppm; and at a distance of about 35 m, about 1 ppm. The odor threshold for styrene was found to be 1 ppm.

ATMOSPHERIC INTERACTION

5584 APTIC NUMBER 14988

Armendariz, Manuel, Laurence J. Rider, and Frank V. Hansen
TURBULENT CHARACTERISTICS IN THE SURFACE BOUNDARY LAYER. Army Electronics Command, White Sands Missile Range, N. M., Atmospheric Sciences Research Office, Task 1T061102B53A-17, ECOM-5225, 9p., Nov. 1968. 6 refs.
DDC: AD 685852

The turbulent characteristics of the first 62 m of the atmosphere over White Sands Missile Range, N. M., were intensively studied using data collected from an instrumented tower. It is demonstrated that important turbulence characteristics such as standard deviation of wind direction, longitudinal intensity of turbulence, and the ratio of the lateral intensity of turbulence to longitudinal intensity of turbulence are dependent upon the height of the wind measurement, the surface roughness, and the stability of the atmosphere. In particular, it is shown that the lateral intensity of turbulence is affected more by stability changes than by roughness or height of the measurement. The longitudinal intensity of turbulence, however, is affected by roughness and height of measurement as well as by the stability of the atmosphere. (Author abstract modified)

5585 APTIC NUMBER 15216

Baker, Donald G., John W. Enz, and Harold J. Paulus
FREQUENCY, DURATION, COMMENCEMENT TIME AND INTENSITY OF TEMPERATURE INVERSIONS AT ST. PAUL-MINNEAPOLIS. J. Appl. Meteorol., 8(5):747-753, Oct. 1969. 3 refs.

Temperature data for the period June 1961 through July 1968, obtained from thermistors installed on a television tower at heights of 70, 170, and 500 feet were analyzed. The tower was located in the heart of the metropolitan area but well outside of the main business district of either city. Only inversions of 2 hrs or more in duration were counted. On an annual basis, only 2.5 inversions per 100 days occurred in the lower level (70-170 ft) compared to 26.4 inversions per 100 days in the upper level (170-500 ft). The total frequency, including the two levels and the deeper inversions that extended over both levels, equalled 85.5 per 100 days. The average duration of inversions within both levels was 6.8 hrs, the 8.2-hr average in October was the longest of any month. Midnight was the single most common hour for inversion formation. Inversion intensity (defined as the temperature difference between levels) varied directly with duration of the inversions. The average intensity of all inversions within both levels was 3.6 F. An inversion rating index was developed that takes into account frequency, duration, and intensity of inversions so that either time periods or sites may be quantitatively compared. The index indicated that the major inversion months were October, August, and September, the minor months being April, March, and May. A decrease in the inversion intensity and frequency over the recorded period was assumed to indicate an increasingly urban influence on the temperature of the region. (Author abstract modified)

5586 APTIC NUMBER 15523

Barrett, Carl and Gunnar Brodin
THE ACIDITY OF SCANDINAVIAN PRECIPITATION. Tellus (Uppsala), vol. 2:251-257, 1955. 4 refs.

The results of a preliminary survey of the spatial and temporal variation of the acid-alkaline balance of precipitation in Scandinavia are presented. Samples of rain and/or snow were collected by a small heated rain-gauge which drained into a plastic sampling bottle. Data on the pH of the total monthly precipitation were given for a Swedish network during July 1953-June 1954. Well-defined regions existed of acidity and alkalinity relative to the pH of water in equilibrium with atmospheric carbon dioxide. These regions persisted to such an extent that the monthly deviations from the pattern of the annual mean pH at each station were relatively small. The mean pH of the entire network showed a distinct annual cycle, with the greatest acidity in the winter and the greatest alkalinity in the late spring. Coastal stations unaffected by local pollution showed persistently high acidity, while inland northern stations showed equally persistent alkalinity. The high acidity in the coastal regions was difficult to explain. The possibility of the sea as a source was considered. Organic acids which are products of biological activity may be concentrated in the thin surface film of the sea and dispersed by evaporation of the mechanical action of foaming and bubble breaking. Hydrogen sulfide could also be formed by biological activity. A third possible marine source may be the ionic separation which was observed to occur as a concomitant of the foaming of the sea surface. The alkaline regions apparently resulted from a combination of pollutant effects. The southeastern region coincides with a large area of surface limestone, and the southwestern region is characterized by a high percentage of ammonium ions from biological activity on farms. The annual pH cycle corresponded to the prevailing air flow and rain fall.

5587 APTIC NUMBER 14684

Baum, Werner A.
COMPUTERS AND THE IMPROVEMENT IN WEATHER SERVICES. International Business Machines Corp., White Plains, N. Y., Data Processing Division, Proc. IBM Scientific Computing Symp. on Water and Air Resource Management, Yorktown Heights, N. Y., Oct. 23-25, 1967, p. 375-386.

Meteorological models will grow in importance for use in forecasting the dispersion of pollutants. They will also have major application in the simulation of the urban emission/dispersion system, where simulation is a valuable tool for making an optimum choice of pollution abatement strategy. The pollution-related activities of the Environmental Science Services Administration depend on the computer installation at the National Meteorological Center. Computer-prepared forecasts present three kinds of data: the depth of the atmosphere available for mixing pollutants, the average wind speed within these layers, and the precipitation. Requirements for computer forecasting are an appropriate set of equations, i.e., the mathematical model; means to solve the equations fast enough

to make the results useful; and a sufficiently complete description of the atmosphere. Increasingly sophisticated and realistic models are anticipated. They will include such factors as variable solar energy input, topographic effects, varying subsurfaces such as deserts and oceans, and fluctuations in atmospheric composition. They will ex st on scales from urban to global. Inadequate atmospheric data is currently the most serious limitation on meteorological forecasting, but global weather observing capability may be improved by the United Nation's World Weather Program.

5588 APTIC NUMBER 15308

Rockian, A. H., Frank Bonamassa, Herbert Faigin, and Herman Pinsky
USE OF THE INTEGRATING NEPHELOMETER TO MEASURE AEROSOL FORMATION FROM HYDROCARBONS. Preprint, California Air Resources Board, Los Angeles, 9p., 1969. (Presented at the Am. Chem. Soc., 158th Natl. Meet., New York, 1969.)

A recently-designed integrating nephelometer was used in environmental chamber experiments to measure light scattering resulting from the irradiation of different hydrocarbons in the presence of nitric oxide at ppm levels. In some of the experiments, 2 ml of gasoline were used; in others, several individual alkene and aromatic components of gasoline, in concentrations of 2 ppm each, were irradiated separately in the presence of 0.4 ppm nitric oxide for about 5 hrs. Six ppm of some alkanes found in gasoline were also allowed to react individually with 0.4 ppm NO. Several other experiments were performed in which the hydrocarbon was allowed to react with ozone in the dark. Agreement in the amount of light scattering between duplicate runs was excellent. In several cases, large amounts of aerosol were produced while the net oxidant concentrations were at a fairly low level. It was shown that some short-chain olefins, which may be very reactive in producing oxidant and eye irritation, produced little or no aerosol; in contrast, many paraffins which were found to be non-reactive in eye irritation studies produced aerosol. A great many aerosol producers contain seven or more carbon atoms and do not seem to be restricted to any class of hydrocarbon; a possible synergistic action between a short-chain high oxidant producer and a large molecule which produces aerosol remains to be investigated. The agreement between nephelometer readings and visual measurements of visibility was excellent.

5589 APTIC NUMBER 18676

Boyer, A. F., F. B. Taylor, T. V. Ward, and F. J. Gottlich
ATMOSPHERIC DISPERSION OF SATURATED STACK PLUMES. American Institute of Chemical Engineers, New York, N. Y., American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., American Society of Civil Engineers, New York, American Society of Heating Refrigerating and Air Conditioning Engineers, New York, American Society of Mechanical Engineers, New York, and American Society for Testing and Materials, Philadelphia, Pa., Proc. NPCAP Symp., Design and Operation for Air Pollution Control, New York, N. Y., 1968, p. 32-40. 13 refs.

Increased use of wet scrubbers has renewed the controversy over the behavior of wet plumes. Observations of plumes emitted from power house scrubbers show conclusively that warm, saturated plumes rise to considerable heights and disperse in the same manner as dry plumes. Plume heights were obtained by scaling photographs taken at stack and ground levels, and determining the ratio of stack height to plume height. In five out of six observations, the wet plume height ranged from 108 to 205% of the height for a dry plume, as calculated from the Holland plume rise formula. It appears that the degree of saturation of a stack plume is less important than the degree to which the plume is cooled during the scrubbing process. It is estimated that because of plume cooling, a reduction of only 6% in ground level concentrations is achieved using an 80% efficient scrubber. This apparent reduction in efficiency results from a lower plume rise of the cooler plume.

5590 APTIC NUMBER 15001

Bullrich, K., P. Fiden, G. Fschelbach, P. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
RESEARCH ON ATMOSPHERIC OPTICAL RADIATION TRANSMISSION. THE EXTINCTION COEFFICIENT OF A PARTICLE POPULATION AS A FUNCTION OF THE RELATIVE HUMIDITY. Johannes-Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, Contract F 61052-67-C-0006, APCRI-69-0266, Final Report, p. 11-29, 108-111, Dec. 1, 1967 to Nov. 30, 1968. 38 refs.

The influence of atmospheric aerosols on visibility was studied, and a model was developed to describe in detail extinction coefficients of territorial and oceanic atmospheric aerosol particles as a function of relative humidity. The effect of changes in the refractive index on the efficiency factor of extinction of individual particles was investigated, as were increases in particle size. Calculations show that at low relative humidities, the efficiency factors for the extinction of individual particles are not markedly influenced by the relative humidity. As long as the relative humidity does not exceed 0.9, the change of the aerosol extinction coefficient with changes of relative humidity is proportional to the change of the square of particle radius. For relative humidities which are higher than 0.9, the rate of change of the collective efficiency factor for extinction as a function of the relative humidity begins to increase noticeably. With increasing relative humidity there is increase in size parameter of particles and a simultaneous decrease in the real part of the complex refractive index.

5591 APTIC NUMBER 15296

Charlson, R. J.
ATMOSPHERIC VISIBILITY RELATED TO AEROSOL MASS CONCENTRATION. A REVIEW. Environ. Sci. Technol., 3(10):913-918, Oct. 1969. 50 refs. (Presented at the Symposium on Colloid and Surface Chemistry in Air and Water Pollution, Div. of Colloid and Surface Chemistry, 156th Meeting of the Am. Chem. Soc., Atlantic City, N. J., Sept. 1968.)

Present and recently acquired knowledge of the relationship between mass concentration of aerosols and the visual range is summarized. Atmospheric aerosols of relative humidity less than about 70% result in physically understandable visibility reduction. Of particular practical importance is the relationship between the mass concentration of atmospheric aerosol and the extinction coefficient due to scatter. Although the relationship between these two quantities is dependent on many variables and is complicated, an approximate proportionality between them was demonstrated both experimentally and theoretically. Of 238 cases measured with an integrating nephelometer, 90% had a mass concentration-visual range product of about 1.8 g/sq m. Even this represents only a factor of 2 in terms of accuracy, the application to such problems as air quality standards seems possible. In view of the scarcity of such relationships or of better accuracy, this application seems valid. (Author conclusions modified)

5592 APTIC NUMBER 15580

Collins, John Monroe
THE EFFECT OF TOTAL PARTICULATE AND RELATIVE HUMIDITY ON VISIBILITY IN THE SALT LAKE VALLEY. Utah Univ., Salt Lake City, Dept of Civil Engineering, Thesis(MS), June 1968, 107p., 18 refs.

A relation between visibility and relative humidity and total atmospheric particulates was established for the Salt Lake Valley by collecting particulate data three valley stations, visibility, temperature, and relative humidity data from the weather bureau at Salt Lake City airport, and then selectively averaging the data to represent accurately the aerosol system of the valley. Selective average was found to be the best technique for combining data so that relative humidity and total particulate data could be grouped in one mile visibility cell intervals. The regrouped data were then used in the relationships developed by other authors. When limited verification was found, it was decided to combine these works by a general equation based on Middleton's basic visibility equation. The general equation assumes that a well-aged aerosol system exists and that individual particles are spheres. A specific form of the equation using a selective one day average was then derived for the Salt Lake Valley data. Factors other than relative humidity and total particulates that cause reduced visibility are not considered. The equation has a multiple correlation coefficient of 0.96. Mathematical analysis of Salt Lake Valley data shows that relative humidity exerts a greater influence on visibility than do particulates. The specific equation can be used with past visibility and relative humidity observations to calculate total particulate values. Obtained values could be translated into a pollution index applicable to both current and past data and providing an indication of the trend in the level of air pollution.

5593 APTIC NUMBER 15585

Duncan Rulon Cook
THE DISTRIBUTION OF OZONE POLLUTION IN THE SALT LAKE VALLEY: A PRELIMINARY GEOGRAPHICAL STUDY. Utah Univ., Salt Lake City, Dept. of Geography, Thesis (MS), Aug. 1968, 122p. 70 refs.

The horizontal and vertical distribution of ozone in the Salt Lake Valley was determined, and the distributional pattern related to man's activities and existing meteorological conditions. Sampling was carried out during eleven airplane flights in August and September, 1967, and June, 1968. A Mast Ozone Meter was used to measure the concentration of ozone in the air brought into the plane's cabin through glass tubing. The horizontal distribution was assessed by flying a series of transects over the valley. Vertical profiles of ozone concentrations were determined by spiralling over specific locations. A comparison of ozone levels wass also made in outlying areas to those in the Salt Lake Valley. Results show a buildup of ozone during the day throughout the valley with distributional patterns of high and low concentrations dependent on wind direction and its relation to the source area. In the morning, local down-valley winds carry the higher concentrations north and northwest of the city. In the afternoon, when winds, are up-valley, maximum concentrations are observed in the southern part of the valley. Under strong southerly gradient winds, concentrations are lower than during local winds. They remain low in the southern part of the valley throughout the day, increase slightly northward in the region of greater human activity, and reach a maximum north and northwest of Salt Lake City. In thy valley, a buildup in the vertical distribution of ozone in the lower elevations is evident. During midday, the ozone shows higher concentrations near the ground under stable atmospheric conditions and low wind velocities. With greater wind velocities, higher ozone concentrations are mixed to a higher altitude. Ozone concentrations in Salt Lake City are two to three times greater than those in outlying areas. (Author abstract modified)

5594 APTIC NUMBER 14989

Dudel, Helmut P.
A COMPILATION OF TABLES OF METEOROLOGICAL VISIBILITY STATISTICS. Army Missile Command, Redstone Arsenal, Ala., Physical Sciences Lab., Proj. DA 1X5791910330 and DA 1V01A501B53A, RR-TR-66-10, 192p., July 21, 1966. 9 refs.
AD818480

Tables of conventional meteorological visibility statistics which were extracted from various climatological summaries are compiled. Visibility data are presented for 88 stations, with North American locations predominating. Table formats vary with data sources but the majority are arranged to show relative frequencies by month, absolute frequencies by hour of day for the month with locally worst visibility conditions, and absolute frequencies by hour of day for the month with locally best visibility conditions. Although the collection is nonhomogeneous in various respects, it permits comparative studies between visibility conditions of all major climatic zones. (Author abstract modified)

5595 APTIC NUMBER 18698

Fletcher, J. O.
MANAGING CLIMATE RESOURCES. Rand Corp., Santa Monica, Calif., 30p., Feb. 1969. 45 refs.
CFSTI, DDC: AD 688386

Human activity is influencing climate on a global scale to the extent that purposeful management of climatic resources will become necessary. The influencing factors most frequently mentioned are carbon dioxide, smog (dust), and heat pollution. High CO2 concentrations decrease the radiative loss to space because the radiation comes from a higher, and hence cooler, level in the atmosphere. Increases in CO2 thus increase the 'greenhouse' effect and cause global warming. For the next few decades, the effects of heat pollution will be insignificant on the global scale. They will be important sometime in the next century. Smog, which includes all forms of industrial pollution, is probably responsible for a 30% turbidity increase per decade and for the temperature decline of recent decades. The most theoretically effective approaches to weather modification are not within the range of present day technology. On the other hand, various ways of influencing thermal losses and inputs to the atmosphere are presently achievable. The diversity of thermal processes that can be influenced in the atmosphere, and between the atmosphere and ocean, offers promise that climatic resources can be maximized and unwanted changes avoided. Engineering proposals for altering the pattern of thermal forcing of circulation indicate that a technological threshold has been reached from which progress can be proportional to the investment of effort. Scientific and government leaders must organize the necessary resources.

5596 APTIC NUMBER 13616

Fortak, H.
TASKS AND ADVANTAGES OF MATHEMATICAL-METEOROLOGICAL DISPERSION MODELS IN THE FIELD OF AIR POLLUTION. (Aufgaben und Moeglichkeiten von mathematisch-meteorologischen Diffusionsmodellen auf dem Gebiet der Luftreinhaltungs.) Translated from German. Free Univ. of Berlin, Inst. for Theoretical Meteorology. 20 p., 1968. 2 refs. (Presented at the Symposium on Meteorology and Air Hygiene, Berlin (West Germany), April 20, 1968.

This paper discusses those air pollution problems which can be solved by theoretical meteorology with the aid of mathematical meteorological dispersion models. Such problems are: (1) short-term forecasts of the extent of air pollution in larger areas, (2) forecasts of statistical properties of air polluted areas based on changes in environmental conditions at the emission source, the air pollution base line, and city planning, and (3) the computation of minimum stack heights for newly-erected industrial plants. It is pointed out that reliable mathematical-meteorological models are available to describe the turbulent mixing and atmospheric transport of air pollutants. The models permit special and temporal descriptions of air pollution situations by using familiar emission data and the knowledge of dispersion conditions. With this data fed into a computer, the model supplies the computed air pollution concentrations for an arbitrarily selected point within or near industrial centers. The greatest importance of such mathematical models is in the field of air pollution oriented city planning. Presently, the statistical model is more reliable than the model for short-term forecasts. The last section of the paper discusses the computation of the SO2 base line for the city of Bremen, (West Germany).

5597 APTIC NUMBER 15661

Friend, James P. and Robert J. Charlson
DOUBLE TRACER TECHNIQUES FOR STUDYING AIR POLLUTION. Environ. Sci Technol., 3(11):1181-1182, Nov. 1969. 8 refs.

Traditional models for predicting the diffusion and transport of pollutants from sources assume that the pollutant or tracer is conserved. These models are appropriate only for materials which are sufficiently inert or long-lived. Real air pollution problems involve materials which are both reactive and relatively inert. Examples of this are nitrogen oxide and carbon monoxide from automobile exhaust, or sulfur dioxide and carbon dioxide from burning of fossil fuels. Study of these double tracer systems is warranted because the reactive materials exist in actual urban atmospheres and because situations can be found where a single case of sources of each pair is dominant, e.g., virtually all NOx and CO come from automobiles in cities such as Los Angeles, and a relationship between the concentrations at the source has been shown to exist. Similarly, CO2 might be related to SO2 in New York. In these cases, CO and CO2 are assumed to be conserved, while NOx and SO2 may be removed by either atmospheric reactions or interactions with surface materials. Simultaneous observation of the reactive and conserved species from a single class of sources will permit the determination of the importance of removal by chemical reaction relative to meteorological processes. It should provide information concerning the importance of chemical sinks for reactive materials in the planetary boundary layer.

5598 APTIC NUMBER 15511

Prizzola, John A.
THE ASCENT OF POWER PLANT PLUMES DURING VARIOUS METEOROLOGICAL CONDITIONS. Preprint, Brookhaven National Lab., Upton, N. Y., 19p., 1969. 19 refs. Presented before the American Power Conference, Annual Meeting, 31st, Chicago, April 22-23, 1969, Paper BNL 13513.1

The theory of forced plume use from tall stacks, such as those used in the power industry, is reviewed, and factors affecting plume behavior are discussed. Two equations are suggested for obtaining a reasonable first approximation for plume rise during various weather conditions; they contain both important source and meteorological parameters. The equations are not valid during occurrences of light wind speeds since, at 1000 ft or above, plume rise depends on the presence of small discontinuities in the environmental lapse rate for unstable or neutral conditions. The meteorological conditions are assumed to prevail over durations of time equivalent to the averaging time selected for

the passive diffusion parameters used in predicting ground level concentrations. Since the plume fluctuates from moment to moment, an hour is required to obtain an average plume height. It is emphasized that the equations are primarily intended for solving simple problems. As more observations of plume ascent and passive diffusion become available, particularly at heights above several hundred feet, further refinements will be necessary and desirable.

5599 APTIC NUMBER 14314

Halliday, E. C. and Otel Kemeny
THE EFFECT OF SUNRISE AND SUNSET ON THE CONCENTRATION OF ATMOSPHERIC POLLUTANTS. Intern. J. Air Water Pollution (London), vol. 4:43-47, 1960. 5 refs.

Measurements of smoke concentrations in the high plateau of the interior of South Africa were the basis of experiments on the variation of concentration of pollutants with height above ground at a fixed time, and with lapse of time for a fixed sampling place. The hypothesis is presented that the morning and evening maxima of atmospheric pollution observed in many parts of the world are due to the combined effect of two processes. The first is a slow increase in the production rate of pollutants in the hours before sunrise, which falls to a slightly lower value during the day and then decreases to a low value during the night; secondly the rate of dissipation of pollutants increases very rapidly to a high value within an hour after sunrise and decreases to a low value about one hour after sunset. Two factors are suggested that may cause a peak to occur before sunrise: the sudden rise of a gradient wind before sunrise and a situation where the natural fall in smoke emission, after light-up smoke emissions have ceased, takes place before sunrise, as might happen in midwinter. The reverse may explain the afternoon peak: some discussion is given to the possible mechanisms involved. With the aid of this hypothesis, it is possible to construct graphs of diurnal variation of concentration of pollutants, which are of the same general shape as those actually observed. It is not claimed that this is the only process in operation but it is suggested that the process is a regular diurnal one which plays a major role in affecting the changes in concentration of pollutants which are observed. (Author abstract modified)

5600 APTIC NUMBER 14820

Horak, Henry G.
AEROSOL CONCENTRATION AND EXTINCTION IN THE EARTH'S ATMOSPHERE. California Univ., Los Alamos Scientific Lab., N. Mex., Contract W-7405-ENG. 36, Rept. LA-3932, 27p., Oct. 1968. 99 refs.

The scattering properties of the atmosphere are very largely determined by the aerosol content. A survey of the subject with emphasis placed on aerosols above the troposphere is presented. There are three major populations of aerosol particles: those smaller than 0.1 micron radius, which decrease in concentration from 100/cu cm at 10 km to nearly zero at 20 km; those of 0.1 to 2 micron radius with a maximum concentration of 1.0 cu cm at 20 km and a secondary maximum of 0.003/cu cm at 80 to 100 km (the altitude zone of noctilucent clouds); and those of greater than 2 micron radius which have an extremely low concentration in the stratosphere and above. The particles of the second population are the most effective in producing scattering and extinction in the visible wavelength region. Several methods for determining aerosol concentrations and extinction coefficients are briefly described. It appears that laser probing is most promising for future work. The results obtained by various investigators are presented. Large radioactive fallout particles exhibit atmospheric residence times of weeks to months, and radioactivity associated with particles of less than 0.02 micron radius above 27 km and with particles of 0.1 micron radius in the lower stratosphere persists for years. Photometric observations made through the atmosphere are complicated by the effects of extinction and multiple scattering, especially for light paths close to the horizon. Calculations based on radiative transfer theory show that given reasonable atmospheric thicknesses and properties, and for a stellar source or for a uniformly emitting plane source on top of the atmosphere, the diffuse light can exceed the direct, exponentially reduced light for large zenith angles. This effect is enhanced by an increase in the number of aerosol particles and by the presence of a high albedo ground surface. Methods of correcting observations are discussed. The application of the Koschmieder-Barbier equation is described. (Author abstract modified)

5601 APTIC NUMBER 15174

Inouye, Yukita
ON THE TEMPERATURE RISE OVER CITY CENTERS. (Toshi chushin chiiki ni okeru kion no tosho gensho ni tsuite). Text in Japanese. Kisei Kogaku (J. Eye. Chem.), no. 9:1-11, Jan. 1968. 8 refs.

The phenomenon of higher air temperatures over city centers as compared to the temperature over the suburbs is explained in many cases by the greenhouse effect. The air conditions of typical cities of Japan, such as Tokyo, Osaka, Sapporo, and Asahigawa, were analyzed. Sapporo and Asahigawa have a different type of air temperature rise from Tokyo and Osaka. From the estimate of the heat balance of Sapporo, it was concluded that the rise in temperature was not due to the greenhouse effect but to the lessened exposure to sunshine because of polluted air, and to the heat from city boilers and stoves. (Author abstract modified)

5602 APTIC NUMBER 15483

Johnson, Warren B., Jr. and Edward F. Uthe
LIDAR STUDY OF STACK PLUMES. (FINAL REPORT). Stanford Research Inst., Menlo Park, Calif., Contract PH 22-68-33, Proj. 7289, 116p., June 1969. 11 refs.

The feasibility of lidar (laser radar) for stack plume studies was established from the results of an experimental investigation of plume behavior from a 245 m power plant stack in western Pennsylvania. Sixty-four vertical plume cross sections

representative of various types of plume behavior were selected for detailed analysis. Each vertical cross section was built up from 15 to 30 lidar shots at 5 to 8 sec intervals and at elevation angle increments of one-third to 10 deg. Although calculated plume-rise values agree reasonably well with the observations, it is clear from inspection of the cross sections that the important effects of vertical wind direction shear (plume tilting and fanning) and vertical changes in stability (plume trapping) should be taken into account when predicting plume rise and diffusion. Close correspondence between plume tops and levels of increased atmospheric stability was found. Optimum use of lidar for diffusion studies requires provision for obtaining 30 min or hourly plume concentration distributions, as well as allowances for the effect of the lidar noise level upon plume size. The advantages of the mobile lidar technique stem from its ability to obtain measurements remotely and at a high density in space and time. The quantitative application of the technique for obtaining absolute particulate mass concentrations is limited mainly by the accuracy with which the optical characteristics of the aerosol are known. (Author abstract modified)

5603 APTIC NUMBER 15896

Jost, Dieter
MEASUREMENTS ON THE VERTICAL DISPERSION OF CHIMNEY EMISSIONS. (Messungen zur vertikalen Ausbreitung von Kaminemissionen). Text in German. Staub, Reinhaltung Luft, 29(11):452-458, Nov. 1969. 8 refs.

Concentration fields on the lee-side of a stack were measured by aircraft ascents with carbon dioxide as a tracer. The plume axes and maximum time average wind speed were found in the same height. In the inner part of the plume, the carbon dioxide concentration may be described by a Gauss function; below the axes, an exponential function is found by graphic approximation. Whether the concentration field is given by a superposition of several Gauss functions or an exponential function cannot be determined by graphic approximation. (Author summary modified)

5608 APTIC NUMBER 15729

Kozyrev, B. P. and V. A. Bazhenov
THE ROLE OF N2O, CH4 AND CO IN ATMOSPHERIC ABSORPTION IN THE INFRARED. (Rol' malykh atmosfernykh primesey v pogloshchenii infrakrasnoy radiatsii). Text in Russian. Fiz. Atm. i Okeana (Moscow), 5(7):738-744, 1969. 8 refs.

The transparency of minor atmospheric impurities is interpreted in the form of a function of the mass of absorbing gas divided by the equivalent mass of gas needed for 50% absorption at a given wavelength. This function fits available data with a scatter of not more than 8%. When taking into account, the non-uniformity of the atmosphere by the effective mass method, the selection of the fitting parameter (n) may lead to significant error in calculating transparency (T). If the average radiation absorption (A) at the center of the nitrous oxide methane and carbon monoxide and bands varies from 10-90%, then (n) may be selected so that the maximum absolute error in calculating transmission will not exceed plus or minus 10%. Taking into account the variability of (n) with the mass of the gas and the pressure reduces the error in calculating the transparency of minor components to plus or minus 5-7%. Calculating the transparency of various air masses in the centers of N2O, CH4 and CO absorption bands indicates the significant role of minor atmospheric components in the attenuation of infrared radiation.

5605 APTIC NUMBER 15588

Kumai, Motoi
MICROSPHERULES IN SNOW AND ICE-FOG CRYSTALS. Army Terrestrial Sciences Center, Hanover, N. H., Cold Regions Research and Engineering Lab., DA Task 1T061102B52A02, RP245, 10p., March 1969. 29 refs.
DDC: AD 691 326

Electron diffraction techniques were used in an electron microscope examination of spherules found in snow crystals, ice-fog crystals, fallout particles, and fly ash. The central part of the residues of 1004 specimens of natural snow crystals from Greenland, the United States, and Japan were examined and 14 spherules 0.1 to 1.5 microns in radius were found among them. The residues of 658 artificial ice-fog crystals formed from water vapor in flue gases of coal-burning electric power plants at Fairbanks, Alaska, were also examined; nine spherules were found. Spherules similar to those found in ice-fog residues were found in furnace-produced fly ash fallout at Fairbanks, Alaska. The properties of spherules and the mean mass of snow crystals from Greenland are given. The electron microscope study indicated that less than 0.7% of the 1004 snow crystals contained spherules of possible extraterrestrial origin, and that snow crystals are formed mainly on clay mineral particles by heterogeneous nucleation. (Author abstract modified)

5606 APTIC NUMBER 15279

Lentini, Anthony D.
TEMPERATURE TRENDS IN SACRAMENTO - ANOTHER HEAT ISLAND. Weather Bureau, Salt Lake City, Utah, WBTM WR-36, 23p., Feb. 1969. 12 refs.
PB 183055

A study of the temperature regime at Sacramento over a period of 90 years was conducted. The urbanization of Sacramento, California with its building growth, population increase, and general economic climb, produced a heat island. Air-conditioning and motor vehicles apparently add an insignificant amount of heat to the urban environment. The major cause of the heat island, at least in summer, is in the ability of buildings and asphalt paving to absorb and hold incoming solar radiation. Also, the decrease in vegetation which accompanies urbanization cuts down transpiration, thereby effectively adding heat. The downward trend at Davis, California is in general agreement with present theories that the earth's atmosphere has been cooling since 1940. However, some of the observed cooling at Davis must be attributed to the location of the

thermometer shelter from 1960-1968. The Davis thermometer was near ground level and therefore probably influenced by strong heating of the ground on sunny days. The Sacramento thermometer was considerably higher, between 85 and 106 feet above ground level, except for the time between 1958 and 1968 when it was 37 feet above ground. Minimum temperatures at Davis indicate a presence of a nocturnal heat island on campus which over-compensates the large-scale cooling of the earth. If the Sacramento thermometer shelter were at ground level, a pronounced nocturnal heat island might be present there also, perhaps be even more dramatic than the daytime heat island. This study also demonstrated that temperature records in an urban environment tend to mask real long-term climatic changes. The role of air pollution should be taken into account but was not included in this study.

5607 APTIC NUMBER 14906

Lesnik, G. F.
CERTAIN RESULTS OF INVESTIGATIONS OF ATMOSPHERIC SURFACE LAYER TURBULENCE. Tr. Gl. Geofiz. Observ. (Leningrad), no. 205:148-157, 1967. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio. Translation Div., 6p., Nov. 15, 1968. CFSTI, DDC: AD 686 025

At the Voltushi weather station, observations of the structure of turbulent flows were conducted simultaneously with gradient and actinometric observations. The purpose of this work was to obtain structural and special characteristics of turbulence in the surface layer of the atmosphere and to test to new equipment for measuring the pulsation of wind speed. The equipment consisted of thermocouples and acoustic anemometers, which permitted the simultaneous recordings of three random processes: pulsations of temperature, and longitudinal and vertical components of wind speed. Measurements were taken four to six times a day for two months and at hours corresponding to the most stationary state of the surface layer. Contact anemometers measured wind speed at heights from 0.25 to 8.6 m. Experimental data is given on dispersion and time of averaging for wind speed and temperatures, correlation, structural, and spectral characteristics of turbulence over a wide interval of scales. The balance of energy of turbulence is also examined.

5608 APTIC NUMBER 15199

Lloyd, A. H.
DISPERSAL OF STREPTOMYCETES IN AIR. J. Gen. Microbiol., vol. 57: 35-40, 1969. 9 refs.

The aerial dissemination of streptomycete propagules originating from the soil was studied. Air was sampled hourly on 30 days above a plot of land which was formerly used as a nursery for peach trees then cropped once with beans and finally left fallow for a year. The number of streptomycete propagules trapped from the air depended on the amount of dust in the air. Less than 20% of the propagules occurred individually. The remainder were mostly attached to the surface of airborne soil particles. Thus, any action which disturbed the soil surface and launched soil particles into the air, such as the operation of an agricultural implement or a gust wind, also increased the concentration of airborne streptomycete propagules. With simulated rain, the first water drops which struck the soil surface launched both individual spores and spores attached to soil particles into the air. As time progressed, the water drops washed most of the propagules from the air.

5609 APTIC NUMBER 14887

Mayer, P. A.
DEVELOPMENT OF AN ATMOSPHERIC DIFFUSION MODEL. Operations Research Inc., Silver Springs, Md., Contract DA 42-007-AMC-163(T), FR 378, 60p., April 30, 1966. 99 refs. CFSTI: AD 688 328

A method for developing diffusion models to substitute for those now in use is discussed. Fluid dynamics theory applicable to travel of low-altitude clouds of gases or fine particles and treats turbulent and vortex flow over rough terrain are reviewed. The method is based on following the transfer of energy from release to its ultimate evolution into heat. It separates the development of a diffusion model into four phases; release, transport, mixing, and impact. The release phase includes the effects of aircraft wake and the inertia of the air mass. The transport phase includes the effects of viscosity, inertia, heat transfer, buoyancy forces, and atmospheric stability. Mixing is treated as energy transfer from large eddies to smaller eddies, through fine turbulence, to heat. The impact phase considers the effects of surface irregularities and roughness, wind shear, and temperature fluctuations. (Author abstract modified)

5610 APTIC NUMBER 14382

McCartney, Earl J.
DESIGN FOR AN ATMOSPHERIC DIFFUSION MEASUREMENT SYSTEM. Sperry Rand Corp., Great Neck, N. Y., Sperry Gyroscope Div., Contract F19628-67-C-0065, Proj. 0000-00-01, Task DOD 61430014, Work Unit DOD 680100, APCRL-68-0499, 124p., July 15, 1968. 12 refs. CFSTI, DDC: AD 688141

The design of an optical system for measuring turbulent diffusion processes in the boundary layer by means of a discrete cloud of tracer particles and a remote optical probing technique is presented. A spherical cloud of monodisperse tracer particles is formed within a period of about 0.1 sec by an aerosol bomb. Consecutive, vertical cross-sections of the cloud are illuminated by a pulse laser and individually photographed by a synchronized camera. Analyses of the photographs by a microdensitometer yield basic data on distribution of particle concentration over each cross section. From these data and the recorded geometry, data reduction procedures then enable a determination of the center of mass, concentration distribution relative to the center, and the trajectory of the cloud. On the basis of work done to date, the following measurement capabilities appear feasible. Particle concentrations less than 200/cu cm can be detected at night or during moderate

twilight. If the initial concentration is 100,000/cu cm, diffusion processes can be followed down to less than 0.002 of the initial concentration. Minimum detectable concentration in daytime will be somewhat greater because of the bright sky background. Resolution of the system to concentration gradients is between 1 and 2%. Accuracy of locating a well-defined gradient is about 2 milliradians with respect to laser and camera azimuths. The system and hardware components are characterized by many trade-off factors. The design provides a fair amount of field flexibility for adjustment of certain parameters. The report presents full discussion and data of major design objectives, nature of the problems involved and various technical considerations, description of the system and hardware, supporting investigations, system performance analysis, and calibration and data reduction. (Author summary modified)

5611 APTIC NUMBER 15285

McElroy, J. L.
LITERATURE SURVEY ON STRUCTURE OF URBAN BOUNDARY LAYER. Preprint, Public Health Service, Washington, D. C., 106p., Feb. 10, 1969. 255 refs.

A literature survey on the structure of the urban planetary boundary layer is presented. Very little is known about the detailed structure and physical governing processes in the planetary boundary layer above the surface layer. Studies over very large roughness elements such as found in cities have only recently begun and are primarily confined to forests. Basically, the results show a mechanical effect which decreases rapidly with elevation. Results of tower studies and balloon and aircraft ascents over cities show that in the daytime, the urban and surrounding rural environs have similar temperature lapse rates. At night, the urban atmosphere is usually warmer. The boundary layer development appears to be governed by boundary layer parameters in the upwind rural area, decreasing in depth and slope with stable, light wind conditions, and increasing with less stable, higher wind situations. Studies of the turbulent structure of the nocturnal urban environment show that the city drag effect changes the shape of the wind profile, decreasing speeds throughout the depth of the boundary layer. Tracer studies of diffusion over urban areas contribute results which are consistent with the turbulent structure findings. Single box-like, mixing depth models were derived to depict the structure of the nocturnal urban boundary layer as far as the city center. Numerical simulation of joint effects of thermal stability and surface roughness on airflow and boundary layer development above an isolated warmer surface were recently initiated. The results show that the effect of enhanced roughness is to cause enhanced vertical velocities and hence greater mixing within the modified layer. Conventional methods of measuring boundary layer parameters often fail over cities because of surface obstructions and danger to life and property. New techniques like doppler radar to measure wind profiles, lidar (laser radar), fast response instrumentation in heliocopters to measure pollution profiles, millimeter wave radiometers to measure temperature profiles remotely, and instrumented tetroons to measure boundary layer parameters appear promising. The survey indicated that numerical simulation is just as promising as wind tunnel studies for the urban problem.

5612 APTIC NUMBER 18611

McKay, H. A. C.
AMMONIA AND AIR POLLUTION. Chem. Ind. (London), 1969:1162-1165, Aug. 23, 1969. 15 refs.

The main oxidation product of sulfur dioxide in the atmosphere is often ammonium sulfate rather than sulfuric acid. The presence of ammonium sulfate aerosol has been previously demonstrated by chemical analysis and by identification of individual particles as ammonium sulfate crystals. There is experimental evidence that at typical atmospheric levels, the reaction between ammonia gas and sulfuric acid droplets is very fast so that the two cannot coexist for more than a few seconds. It is doubtful whether neutralization of free sulfuric acid represents the principal route to ammonium sulfate and a sufficiently fast mechanism for the oxidation of sulfur dioxide was difficult to explain. If oxidation in the presence of ammonia is considered, further possibilities arise, and the expected product is ammonium sulfate. This might occur in the gas phase, in water droplets, or in solid particulate matter. Different reaction mechanisms are discussed. It appears that atmospheric ammonium sulfate is produced when ammonia contacts sulfur dioxide from combustion in the presence of a water droplet phase. About half the ammonia may react before a falling pH virtually stops the reaction. When no water droplets are present, the reaction may perhaps occur on solid particulates.

5613 APTIC NUMBER 15387

Meyer, Erich
SULFUR DIOXIDE EMISSION AND SMOG FORMATION.
(Schwefeldioxid-Emission und Smog-Bildung). Text in German.
Chem. Ing. Tech., 41(19):1056-9, 1969. 13 refs.

In 1962, 35% of atmospheric SO2 in West Germany was emitted by thermal power plants, 46% by other industrial sources, and 19% by domestic heaters. In 1965, power plants emitted 29%, the remaining industrial and domestic sources 71%. The atmospheric SO2 concentration (mg SO2/cu m) depends on stack height, the amount emitted, distance from the source of emissions, and on meteorological factors. Among the latter, temperature-lapse rates have great importance. The formation of smog depends not only on SO2 levels and inversions, but also on the catalytic activity of finely divided solid particles, intense solar radiation, and high relative humidity. Measures for limiting SO2 emissions are outlined. These fall into three categories: decontamination of fuels or removal of the toxicants from waste gases, the use of low-sulfur fuels, and curtailment of industrial operations.

5614 APTIC NUMBER 15919

Milhau, Alain, Aise Druilhet, Jacques Fontan, and Jean Ricard
DETERMINATION OF THE COEFFICIENT OF VERTICAL TRANSFER OF MATTER

BY TURBULENT DIFFUSION FROM THE ELECTRICAL PARAMETERS OF AIR. (Determination du coefficient de transfert vertical de matiere par diffusion turbulente a partir des parametres electriques de l'air). Text in French. C. R. Acad. Sci., Paris, Ser. B, vol. 269:681-684, Oct. 13, 1969. 8 refs.

A theoretical model of atmospheric electricity is proposed in which the vertical electric current, I, is the sum of a conduction and a diffusion current. I equals lambda F -K(dp/dz), where F is the electric field intensity; p is the space charge; z is the altitude above ground; lambda is the electric conductivity of air; and K is the diffusivity of air, that is the coefficient of vertical transport of matter by turbulence diffusion.

5615 APTIC NUMBER 13758

Narita, Gotsuei
METEOROLOGICAL STUDIES ON AIR POLLUTION IN MURORAN, HOKKAIDO (FIRST REPORT). (Muroran-shi no taiki osen ni kansuru kisho-chosa (daiichi ho)). Text in Japanese. Kishocho Kenkyu Jiho (Journal of Meteorological Research, Tokyo), 19(10):552-556, Oct. 1967. 1 ref.

In January, 1966, the city of Muroran was designated an air-polluted area. During the period of investigation (June 1965 to May 1966), two large iron industry plants located in the eastern part of the city emitted smoke which included SO2. Mist and/or smog was most frequently observed between 9:00 p.m. and 9:00 A.M., disappearing in the morning. A weak north-northeast wind was most frequently seen during periods of smog, while a west-north-west wind, which was slightly stronger than the former, was most frequently seen during the period of absence. An air-layer inversion, which caused the wide spread of smog, was clearly observed when the surface wind was north-east or southeast in direction, or when the temperature difference between air and sea water was great. High concentrations (more than 0.5 ppm) of SO2 were most frequently observed between 12:00 noon and 10:00 p.m., especially in November and March and when there was a strong (7 to 10 m/sec) northwest wind. Concentrations of SO2 were highest in the area within 1 km downwind from these plants.

5616 APTIC NUMBER 15877

Orton, Robert
THE METEOROLOGICAL POTENTIAL FOR AIR POLLUTION IN TEXAS. Texas Business Rev., 42(10):1-6, Oct. 1968. 3 refs.

The meteorological parameters of air pollutants and the topographic and climatological factors affecting pollution in Texas are reviewed. The state's air-pollution potential is considered. The capacity of the atmosphere to dilute pollutants is highly variable in time and space. In Texas, the seasonal and geographical variations in the meteorological potential for air pollution are considerable. For the state as a whole, the most serious pollution episodes are likely to occur in December and January. For the northeastern section of the state, the month of November must be included in this category. Serious air-pollution episodes are least likely during the warmer months of the year. High wind speeds and high mixing depths occur with greater frequency in West Texas than in East Texas; consequently, the potential for serious pollution episodes is lower, on an annual basis, in West Texas. There is considerable variation in the frequencies of light winds at night, both geographically and seasonally. The magnitude of these frequencies is of obvious importance where pollutants are emitted at night. On an annual basis, light night winds occur least frequently on the high plains and on the middle Gulf coast. They occur with greatest frequency in southeastern and southwestern Texas. Seasonally light night winds occur with greatest frequency in summer and fall. The cold California current is partially responsible for serious air-pollution episodes along the southern California coast in September and October. Because the Gulf of Mexico is relatively warm during these months, and since there is no cold current offshore, the dilution capacity of the atmosphere remains relatively high along the Texas coast in September and October. Few high-pressure systems stagnate over Texas for any length of time; therefore, the meteorological situation most favorable for serious air-pollution episodes rarely is present. In Texas stagnation is more likely to occur over the East Texas Pine Belt than elsewhere. Thus, the Texas climate, characterized by frequent changes in air mass and by numerous local and regional-scale weather disturbances, does not favor objectionable concentrations of air pollutants much of the time. However, the frequency of occurrence of light winds and temperature inversions at night may create pollution problems at some locations during certain periods of the year. (Author conclusions modified)

5617 APTIC NUMBER 15390

Peterson, James T.
THE CLIMATE OF CITIES: A SURVEY OF RECENT LITERATURE. Public Health Service, Durham, N. C., National Air Pollution Control Administration, Pub. AP-59, 48p., Oct. 1969. 127 refs.

The meteorological aspects of urban-rural climate are reviewed with respect to temperature, humidity, visibility, radiation, wind, and precipitation. The 'heat island' effect (due to the center of a city being warmer than its environs) is discussed with reference to possible reasons for its occurrence; diurnal, weekly, and seasonal variations; relation to city size; and dependence on topography. The average relative humidity in towns is lower than that of rural areas; the average absolute humidity is only slightly lower in built-up regions. The differences in humidity are due to lower evaporation rates in a city because of the different surfaces. Variations within metropolitan areas resemble those of temperature, since the spatial temperature changes of a city are greater than those of vapor pressure. The atmosphere of metropolitan areas is characterized by increased concentrations of pollutants, such as smoke, which cause a difference between the visibilities of urban and rural regions. Fog is more frequent within urban regions because of the hygroscopic property of atmospheric particulates. The blanket of particulates over large cities causes the solar energy that reaches an urban complex to be less than that observed in rural areas, the particles being most effective as attenuators of

radiation when the sun angle is low. The differences in wind speeds in city and country occur because the surface of a built-up city is rougher than that of rural terrain and because the heat island of a city causes horizontal thermal gradients. The excess heat and friction also produce more turbulence over the urban area.

5618 APTIC NUMBER 18897

Centre Departemental d'Etude des Pollutions Atmospheriques, Paris, Section Sante et Meteo.
A DAY OF POLLUTION IN THE LACQ REGION. (Journee de pollutin vecue dans la region de Lacq). Text in French. Pollut. Atmos. (Paris), 11(Special):36-40, Feb. 1969.

Observations and measurements of pollution are reported for the period from Oct. 4 to 5, 1968, in the 15 km-wide valley of the Gave de Pau. On the night of Oct. 4, a 4-day old descending inversion reached an 11-degree amplitude with a 700-m thickness. Early morning pollution was near zero, but as the fog cleared and wind conditions of less than 1 knot prevailed, pollution indices rose greatly. Later in the day the wind rose, and in the absence of any inversion, pollution dropped by a factor of 10. A gas desulfurization plant in the valley emits 500 to 1000 tons of sulfur dioxide daily. Measurements made by absorption of acid gases in glycerinated 0.5 NaOH, in hydrogen peroxide solution, or in glycerinated zinc acetate gave qualitatively similar results. Emissions were from a 104-m high chimney, but maximum ground level pollution was found 5 km from the chimney, a distance about 40 times the theoretical chimney height, i.e., the plume height above the chimney. Another source of pollution in the valley is an aluminum extraction plant which employs the Soderberg process and emits 150 kg per day of fluoride ions. Measurement by exposure of lime-impregnated papers, with colorimetric estimating techniques, correlated in 70% of the cases with direct absorption on fiberglass, and was reproducible to better than 10%. Decrease of pollution with distance was found to be exponential, with the worst pollution occurring within 2 km of the plant.

5619 APTIC NUMBER 15873

Raynor, Gilbert S.
EFFECTS OF A FOREST ON PARTICULATE DISPERSION. Atomic Energy of Canada Ltd., Chalk River, Ontario, Chalk River Nuclear Labs., Proc. U. S. At. Energy Comm. Meterol. Inform. Meet., Chalk River, Ontario, Sept. 1967, p. 581-598. 2 refs.

The dispersion and deposition of pollens from an experimental source in a forest was studied. The objectives were to determine the behavior of the plume as it approaches the forest edge as a function of the release site and meteorological conditions, to determine the dispersion rate within the forest as compared to the rate over open terrain under similar conditions, and to identify the mechanisms important in the removal of particles from the air within the forest. The study area consisted of a fairly dense pine forest with trees about 11 m tall. In addition to air samplers, deposition collectors were exposed on the ground at each sampling position. A comprehensive study was also made of wind and temperature structure within, above, and around the forest. Data from these experiments were compared with data from similar tests over open terrain and with values calculated using a diffusion model which, with appropriate parameters, gave a good fit to concentrations at all levels and to deposition measured in the open fields. Four principal effects attributed to the forest were evident from these comparisons. The plume is broadened both horizontally and vertically by divergence of the wind at the forest edge. Particles tend to penetrate at tree trunk height or to rise above the canopy following the wind pattern. Loss of particulates occurs mainly in two stages and by two mechanisms, impaction near the forest edge and deposition well within the forest. Total loss of particulates over the distance studied was considered greater than over open terrain. These results suggest that the flow field induced by the forest, rather than the presence of the vegetation itself, is the primary cause of the dispersion pattern observed.

5620 APTIC NUMBER 15299

Reiter, Reinhold
ATMOSPHERIC AEROSOLS BETWEEN 700 AND 3000 M ABOVE SEA LEVEL. PART III. A STUDY OF THE EFFECTS OF ATMOSPHERIC FINE STRUCTURE CHARACTERISTICS ON THE VERTICAL DISTRIBUTION OF AEROSOLS. (Physikalisch-Bioklimatische Forschungsstelle der Fraunhofer-Gesellschaft, Garmisch-Partenkirchen, Germany, Skistation, Contract DAJA 37 68C-0331, Proj. 2M010501B53B, 83p., Jan. 1969. 5 refs.
DDC: AD 689878

An extensive body of observational data and a preliminary evaluation of the data is reported. The mean vertical mass exchange coefficients between 700 and 1800 m and 1800 and 3000 m were computed from measurements of RaB concentration at three levels. Incremental exchange coefficients of small, vertical adjoining layers (usually 100 m thickness) between 700 and 1800 m were determined from aerological sounding of particle concentration from electrical conductivity measurements. The exchange coefficients are related to the mean lapse rates, stability energy, and maximum local lapse rates in inversions. The effect of air mass changes, heat of condensation and wind shear are discussed. Lapse rates during the measurements ranged from 0.3 C/100 m to 1.1 C/100 m. Computed exchange coefficients vary from 0 to 1000 g/cm/sec. The relation between temperature gradient and exchange coefficient shows considerable scatter, especially in the 800-1800 m region. The region from 1800-3000 m shows less scatter. Regression lines show a change of slope at lapse rates of about -0.2 C/100 m at the lower levels and at about -0.5 C/100 m at the higher region. (Author abstract modified)

5621 APTIC NUMBER 13092

Robinson, G. D.
AIR-LAND INTERACTION, FOG, ATMOSPHERIC OPACITY - A MISCELLANY. Meteorol. Mag., 98(1163):190-198, 1969. 31 refs.

Several of the investigations conducted at Kew Observatory on air-land interactions are reviewed. Investigations of fog and atmospheric opacity have been aimed at specific and immediate problems. An instrumental method for measuring visibility and systematic counts of Aitken nuclei and the large ion content of the air were both begun at Kew. A study was also conducted to determine the size distribution of the particles responsible for atmospheric opacity in fog and haze. The results of this work contain an analysis of opacity in fog at Kew in relation to the particle size distribution, stressing the importance of very small particles which make little contribution to the suspended mass, and the design of an efficient cascade impactor. Investigations of energy and momentum transfer at the ground surface have also been conducted. Flux determinations by the correlation method, and the energy-balance method gave results which agreed within a factor of two for heat flux. Momentum flux, compared with the results of drag-plate techniques, was much less consistently determined.

5622 APTIC NUMBER 15346

Santomauro, Luigi
EXAMINATION OF THE EFFECT ON THE ATMOSPHERE OF MUNICIPAL AND INDUSTRIAL WASTE IN AN URBAN AREA. (Per una ricerca sul comportamento atmosferico degli effluenti civili ed industriali in area urbana). Text in Italian. Acqua Ind., 11(8):9-15, June 1969. 31 refs.

The boundary layer of the troposphere is the part affected by the topography of the ground beneath it. The thermodynamic method of determining the width of this layer is discussed. It is a function of the thermal diffusion capacity of the medium, of the oscillation period of variations in incident solar radiation, and of variations in wind direction and velocity. A boundary substratum also exists, within which the vertical meteorological gradients are more pronounced and within which the determination of conditions is often sufficient for predicting the atmospheric diffusion of pollutants derived from human activities. Widths of stratum and substratum undergo annual variations. Atmospheric conditions can be classed as stable, unstable, or neutral. Ideally, all observations of wind conditions should be from the height of the average level of the emitted fumes. The expense of building special monitoring towers is prohibitive, but radio and television towers can be used as well as balloons carrying the necessary instrumentation, or radar signals. Stability of the atmosphere can be determined by a recording anemometer that also gives continuous data on wind direction. One can also measure the amount of nocturnal cloud cover, together with wind velocity at stated intervals. Existence of an unstable atmosphere does not solve all problems, since a looping effect can influence more remote areas. Three examples of topography are discussed: (1) a homogeneous plain, (2) a valley surrounded by hills, and (3) a seacoast situation. Attempts in many communities to establish quantitative formulas relating pollution possibilities to meteorological conditions have been inadequate. To assume that selection of a particular site for industry will minimize pollution is an oversimplification, since variable local factors are a minor component of the general picture.

5623 APTIC NUMBER 15500

Schoenbaechler, M. and P. Valko
TURBIDITY MEASUREMENTS IN THE CITY OF LOCARNO AND ITS ENVIRONS AND ON AN ALPINE TRIP. (Trueburgsmessungen in der Stadt Locarno und ihrer Umgebung sowie auf einer Alpenfahrt). Text in German. Arch. Meteorol., Geophys., Bioklimatol., Ser. B, 14(1):81-93, 1965. 11 refs.

During a winter temperature inversion, a thick haze layer developed in the northern basin of the Lago Maggiore. The diurnal variation of this haze layer was examined by actinometric and photometric intensity measurements of direct solar radiation at a station at Locarno 238 m above sea level (a.s.l.) and at Locarno-Monti Observatory (380 m a.s.l.). The turbidity was measured simultaneously during a drive with a passenger car at 22 points throughout the city and its vicinity. An altitude of 200 to 730 m a.s.l. was covered. The measurements were taken at various times of day. The haze distribution 9:22 a.m., 10:22 a.m., noon, and 3:24 p.m. is superimposed on a city map. The altitude profile of the turbidity coefficient above the city differs markedly from that found over rural areas. Transmission of visible light through the haze layer dropped to 0.34 at the time of maximum turbidity. On a drive from Locarno to the Gornegrat mountain (altitude 3131 m), radiation measurements were taken, and the turbidity was determined at 14 points using these measurements.

5628 APTIC NUMBER 15758

Sekikawa, Toshio and Hiroshi Kojima
CHARGED FRACTION AND CHARGED EQUILIBRIUM ON THE SUBMICRON AEROSOL PARTICLES IN THE ATMOSPHERE. J. Meteorol. Soc. Japan, 47(5):329-334, Oct. 1969. 12 refs.

Measurements were made to determine whether natural atmospheric aerosols are in a state of equilibrium. The charged fraction of particles constitutes the ratio of the charged particle concentration to the total concentration with respect to atmospheric electricity. Particles ranged in size from 0.0000001 to 0.00001 cm in radius. Aerosol concentration was measured with a nucleus counter or an ion denuder. Sample air containing aerosol particles was irradiated with an alpha-ray for a few seconds to produce a charge equilibrium state. The charged ratio of each radius range was estimated by a comparison of both ion mobility distributions in the equilibrium state and the natural state. The results showed that the charge equilibrium state of aerosol particles was not realized in contaminated air. In addition, the amount of departure from the charged equilibrium state varies for different mobility ranges. An equilibrium state was attained for a short time immediately before sunrise when the atmosphere was comparatively stable. This phenomenon was explained by the fact that the artificial production of aerosols in air is minimized early in the morning. The greatest departure from the equilibrium state was observed at noon.

5625 APTIC NUMBER 14908

Slade, David H.
DISPERSION ESTIMATES FROM POLLUTANT RELEASES OF A FEW SECONDS TO 8 HOURS IN DURATION. Dept. of Commerce, Washington, D. C., Air Resources Lab., Tech. Note 2-ARL-1, 23p., Aug. 1965. 23 refs.

A simple method is presented for estimating dosage or concentration values from point sources of pollution at a specific location. It is based on on-site measurements made with a single wind system. Basic meteorological data required are average wind speed, wind direction, and standard deviation of the azimuthal wind direction, all for a period of 30 min. In using the concepts of turbulence theory to estimate diffusion, it is also necessary to distinguish between 'steady' and 'non-steady' winds. The equations used in constructing the dispersion estimation technique are elaborated. A number of readily rationalized simplifications were used to develop this system of dispersion specification, which is primarily intended for application constructing dispersion climatologies. The method may be used at any location situated in reasonably regular terrain. It should be used with great care, if at all, in areas typified by large, discrete topographic variations such as marked valleys, mountain peaks, and coast regions.

5626 APTIC NUMBER 14855

Smith, Theodore B. and Robert L. Miller
VICTORIA DIFFUSION TRIALS. Meteorology Research, Inc., Altadena, Calif., Contract DA 18-064-AMC-422(A), Report MRI66 FR-378, Final Report., Vol. I, Vol. II, Pt. A and B, 858p., May 1966. 23 refs.
DDC: AD 810817, AD 810818, AD 810819

A series of 17 diffusion trials was conducted at Victoria, Tex. during July and August 1965. The purpose of the study was to determine the relative diffusion characteristics of two types of tracer particles for large downwind distances. The tracers were released simultaneously from a jet aircraft. The large particle tracer had terminal velocity of 1.68 cm/sec and the fluorescent particle tracer had a terminal velocity of 0.5 cm/sec. Release altitudes were 91 m for 16 of the trials while one release was made at 152 m. Sampling was conducted along a downwind line of about 180 km in length with four crosswind sampling lines spaced at distances of approximately 40 km. Towers 91 m high and an HC-47 aircraft were used to obtain vertical profiles of tracer material and meteorological data. Vol. I describes the diffusion trials and presents an analysis of the resulting data. The diffusion environment was found to have a complex vertical structure; the tracer cloud was divided into low level and high level substantial intermixing. Inhomogeneous K diffusion models were found to be most appropriate for an explanation of the observed dosages for both particles. Volume II contains the basic sampler and meteorological data for each trial. (Author abstract modified)

5627 APTIC NUMBER 15673

Japan. Meteorological Soc., Meteorological Res. Inst.
THE CALCULATION DISTRIBUTION OF AIR POLLUTION CONCENTRATION FROM A FEW SOURCES. In: Outline of Study of Air Pollution in Japan, Japan Air Pollution Panel, U. S.-Japan Conference on the Development and Utilization of Natural Resources, Feb. 1965, 2p.

The mean daytime distribution of air pollutant concentration in Tokyo during August (1964?) was calculated from Pasquill's atmospheric diffusion formula and wind roses for Tokyo, Yokohama, and Chiba.

5628 APTIC NUMBER 14793

Vadot, L.
APPLICATION OF A HYDRAULIC ANALOGY TO ATMOSPHERIC DIFFUSION PROSPECTS AND RESULTS OBTAINED IN THE STUDY OF POLLUTION. (Application d'une analogie hydraulique a la diffusion atmospherique. Possibilites et resultats obtenus dans l'etude de la pollution). Text in French. Meteorologie, 1(2):259-271, 1967.

Scale models of fume emission at hundreds of degrees are desirable for study of air pollution. Air as a model does not provide enough information. However, the use of water to study aerodynamics is classical. It is possible to show that the vertical adiabatic exchanges which are accompanied in the atmosphere by volume changes not represented in water entail only a slight error at heights of general interest for pollution. To avoid using great quantities of salt solution, the model is inverted; rising light gas in cooler air being represented by denser falling brine in pure water. Stable stratification is represented by pure water lying over denser salt concentrations. A coloring agent such as fluorescein added to the incoming jet allows direct observation of motions. Conductivity probes maintain instantaneous salt concentrations, providing a complete model. Heat conduction is not correctly modelled but is negligible compared to dissipation by turbulent mixing. A model of flow from a chimney into a windy atmosphere was particularly accurate for angles of motion and pollutant concentrations. It was possible to determine for each case the value for plume elevation and height at which one can apply Sutton's classical scheme of diffusion and descent, i.e., the meteorological phase. Models of plume behavior during atmospheric temperature inversion permitted determination of the plume exit variables (diameter, velocity, temperature) necessary to allow the plume to pierce the inversion layer. A model including a hill downwind from the plume indicated a lowering of the inversion layer there, creating a pollution trap. A study of groups of buildings showed the existence of a particular relationship of height to distance between buildings which promotes maximum pollution in the vicinity. Short chimneys chosen for aesthetic reasons are poor dispersers of waste gas and can promote pollution around the very building they serve. The capture of a plume by sun-warmed rising air was also shown. Even in the absence of wind, the plume can be directed toward and captured by this warmed air and caused to descend on a previously unpolluted area.

5629 APTIC NUMBER 15616

Vadot, L., P. Belle and A. Inard
INVESTIGATION OF THE DISPERSAL OF SMOKE AND DETERMINATION OF THE HEIGHT OF A CHIMNEY. (Etude de la diffusion des fumees et determination de la hauteur d'une cheminee). Text in French. Pollut. Atmos. (Paris), 11(43):131-142, July-Sept. 1969.

The process of smoke dispersal in the atmosphere as emitted from the chimney of a central heating plant to be located at the edge of the ZUP area near Grenoble (France) was studied in the design stages. A hydrodynamic channel was used for diffusion studies as well as a 1:1000 scale model of the plant with a chimney and the larger buildings in the neighborhood. In the analogue model tests, the relative density of atmospheric air was represented by the concentration of NaCl in the water of the channel; smoke outlet temperatures of 100 or 200 C corresponded to NaCl concentrations of 50 or 150 g/l, respectively, of the water injected through the model chimney at the speed of 5 cm/sec. The speed of the water in the channel could be varied between 5 and 25 cm/sec., corresponding to wind speeds between 2.34 and 11.7 m/sec. The height of the model chimney could be varied between 3 and 10 cm. Three cases of smoke dispersal were studied above a flat terrain; in the presence of building on the ZUP; and in an atmosphere with a stable stratification. A total of 32 tests were made and many photographs of the simulated smoke plume under the different test conditions which were used in the test evaluation are shown. On the basis of these tests and other studies, a chimney height of about 75 m, a minimum outlet speed of 15 m/sec and an outlet temperature of the order of 200 C was recommended.

5630 APTIC NUMBER 14825

Yeliseyev, V. S.
THE QUESTION OF HORIZONTAL SCATTERING OF IMPURITY IN THE ATMOSPHERE. (Voprosy atmosfernoy diffusii i zagryazneniya vozdukha). Tr. Gl. Geofiz. Observ. (Leningrad), no. 172:78-78, 1965. 11 refs. Translated from Russian. Foreign Technology Div., Wright-Paterson AFB, Ohio, Translation Div., p. 23-29, 1967. FTD-MT-24-186-67

The method of determination of the coefficient of horizontal diffusion according to a visible outline of smoke from industrial smoke stacks is discussed. Studies of atmospheric contamination in 1962-1963 in area of the Shchekino State Regional Electric Power Station determined the parameters of horizontal diffusion according to data of aircraft observations of the smoke plume. A total of 20 flights was made to a distance where the plume ended, a point where the concentration was considered equal to zero. It was found that the mean dispersion as a function of time varied from 0.1 to 0.2 depending on weather conditions, but its absolute value remained constant to a distance of 30-80 km from the source. The obtained data was compared with characteristics of horizontal diffusion by Sutton. The mean dispersion as a function of time was recalculated to the parameters used in other studies and found to be 0.1 to a distance of 25 km. (Author abstract modified)

5631 APTIC NUMBER 15687

Zdunkowski, Wilford G. and Barry C. Nielsen
A PRELIMINARY PREDICTION ANALYSIS OF RADIATION FOG. Pure Appl. Geophys. (Basel), vol. 75:278-299, April 1969. 10 refs.

The predictability of the behavior of radiation fog was studied by means of a mathematical model. It was assumed that the exchange coefficient is only a function of height, that water vapor and water droplets are the only radiative agents, and the scattering effect of the droplets was disregarded. It was also assumed that the total moisture content of the air is conserved and advection of air was not taken into account. The system of physical equations describing temperature changes near the ground in fog-free air as well as in radiation fog were numerically solved. The variation of the exchange coefficient with height was taken into account using different models while time variations were disregarded. Temperature changes caused by latent heat effects were incorporated into the study and the presence of radiative flux divergence was approximated. Graphs showing development of temperature and water droplet profiles as a function of time and height are presented. Computed liquid water content as well as temperature profiles were in general agreement with observations while vertical growth of fog usually proceeds too rapidly. To simulate nature, attempts must be made to generate internally the exchange coefficient as it varies with height and time. This can be accomplished by including motion and wind equations of the boundary layer in the system of physical equations. The complete radiation theory, which includes droplet scattering, must be incorporated to obtain exact flux divergence values.

5632 APTIC NUMBER 15597

Zurlo, N.
CHIMNEY HEIGHT AS A FUNCTION OF SOIL POLLUTION. (Altezza dei camini in funzione dell'inquinamento al suolo). Text in Italian. Ing. Sanit., 16(4):255-274, July-Aug. 1968. 52 refs.

Guidelines are given for calculating the height of chimneys to be built for a plant expected to emit air pollutants. The Po Valley, an important Italian industrial area, is used as a standard for atmospheric conditions and topography. Thermal inversion is more intensive and extensive here than elsewhere in Italy. Three formulas for calculating the ground concentration of pollutants are used: those of Bosanquet-Pearson, Sutton, and Zurlo-Frigerio. An important objective is to achieve an approximation of the maximum ground-level pollution that will occur in a relatively stable atmosphere. For calculating the height of emission, the most important data concerns the distance from the chimney at which the cone of dispersion touches the ground, and the concentration of pollutants at that point. The area of the path of pollution is also calculated, and is proportional to the square of the elevation from which the emission takes place. A conversion factor must be used to convert height of emission to chimney height, referred to here as 'delta H', which depends on the speed and temperature of the emitted material, its density, and various atmospheric conditions.

5633 APTIC NUMBER 14811

Abel, Nikolaus, Peter Winkler, and Christian Junge
STUDIES OF SIZE DISTRIBUTIONS AND GROWTH WITH HUMIDITY OF NATURAL AEROSOL PARTICLES. PART II. INVESTIGATION OF THE COMPOSITION OF ATMOSPHERIC AEROSOL PARTICLES BY MEASUREMENT OF PARTICLE GROWTH DUE TO ABSORPTION OF WATER VAPOR AND ORGANIC VAPORS. Max-Planck-Institut fuer Chemie, Mainz, West Germany, Otto-Hahn-Institut, Contract AF 61 (052)-965, AFCRL-69-0205, p. 81-63, Jan. 1969. 15 refs.
AD 689189

A gravimetric method is described for the determination of the growth of aerosol samples in vapors of water and organic solvents. Results of measurements for samples of natural and artificial aerosols for water vapor demonstrate the possibilities of the method and some special characteristics of these growth curves, such as the smooth form of the curves and the hysteresis effect. Experiments show that the typical smooth form of the growth curves of natural continental aerosols can be explained by the presence of salt mixtures and insoluble material. It is found that both the mutual influence on solubility among the various ions, as well as interaction between dissolved and insoluble material, tends to smooth the shape of these curves. The study of hysteresis indicated that this effect is due partly to the supersaturation of solutions and partly to the existence of pores in the aerosol particles or at least in the aerosol sample. There is evidence that the effect of the pores is enhanced by the interaction between soluble and insoluble material. The study of growth of natural aerosol particles in organic vapors showed that organic material is present which results in similar growth curves as in the case of water vapor. It became clear, however, that growth in organic vapors will influence the subsequent growth in water vapor, that is, that exposure of the aerosol samples to organic vapors is not reversible. Heating of aerosol samples up to 150 C resulted in mass losses up to 35%. This mass loss is due to both organic and inorganic components. For further systematic study of the organic components in aerosols the so-called 'solution' method was developed. In this method, the mass losses are determined after exposure of the sample to a certain sequence of solvents. (Author abstract modified)

5634 APTIC NUMBER 14539

Adadurov, I. E., M. V. Arinasenko, L. M. Orlova, and A. I. Ryabchenko
EFFECT OF THE COMPOSITION AND DISPOSITION OF THE CONTACT MASS ON THE CATALYTIC ACTIVITY OF CHROMIUM CATALYSTS. (Vliyaniye sostava i raspolozheniya kontaktnoy massy na kataliticheskuyu aktivnost' khromovykh katalizatorov). Text in Russian. Zh. Prikl. Khim., 7(8):1356-1362, 1934. 3 refs.

In spite of their high quality, chromium-tin catalysts have the disadvantage that the activating mixture requires unavailable amounts of tin. Attempts to decrease the requirement of catalytic material by applying it to a carrier have not yet led to favorable results. Efforts to replace tin with other activators have not produced any promising patents for industrial use. Only aluminum oxide at temperatures beginning at 530 deg has given a conversion close to the theoretical yield of approximately 90%. The maximum increase in the amount of sulfur dioxide converted into sulfur trioxide per unit volume of contact mass using a chromium-tin catalyst can be attained by coordinating the reaction with its kinetics and by arranging the contact material according to particle size in the contact apparatus. Arranging the catalyst particles according to the movement of the gas with the largest particles at the top of the apparatus increases contact by 4-5%. The same kinetic principles applied to a two-stage contact process (loading the first converter with a chromium mass activated with aluminum oxide, operating at 550 deg, the second converter with a chromium-tin catalyst, operating at 450 deg) resulted in a productivity increased by 250%. Thus, it appears possible to operate a contact process on a combination chromium catalyst.

5635 APTIC NUMBER 13722

Adamson, Arthur W.
PHYSICAL ADSORPTION---A TOOL IN THE STUDY OF THE FRONTIERS OF MATTER. J. Chem. Educ., 44(12):710-716, Dec. 1967. 18 refs.

The physical properties and behavior of adsorbate molecules were studied to determine total surface area and its distribution with respect to adsorption bond energies. Analysis of the reversible work potential indicates that the dispersion force is attractive and arises as small perturbation of the motions of orbital electrons on each other, and, being a perturbation effect, is nearly additive. For this reason, an adsorbate molecule near the surface of an adsorbent experiences a total attraction which is the sum of all pairs of interactions. Another important type of attractive force is that which arises from the presence of strong electric fields at a surface. It is also shown that if a vapor is physically adsorbed on a rigid solid substrate, the adsorption energy is comparable to the cohensional energy of the liquid adsorbate. One would expect the adsorbed liquid film to be structurally perturbed. Calculations indicate that the soft upper phase will try to come into register with the substrate, with resulting alternating zones of dilation and compression, the intensity of which relaxes exponentially. Two significant conclusions were reached: (1) the adsorbed film must be structurally perturbed relative to bulk liquid when the latter is found to show a fine contact angle on the solid; and (2) there is a very close connection between adsorption, spreading coefficient, and contact angle, with these qualities determined by the way in which the attractive force field and the structural perturbations decay with increasing film thickness.

5636 APTIC NUMBER 14822

Ahmed, Syed M.
MEASUREMENT OF THE SURFACE AREAS OF POWDERS BY KRYPTON GAS ADSORPTION METHOD. CONSTRUCTION AND OPERATION OF THE APPARATUS. Dept. of Energy, Mines and Resources, Ottawa, Can., Mineral Sciences Division, Mines Branch Tech. Bull. 84, 26p., July 1966. 4 refs.

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An apparatus was constructed for studying adsorption of Kr on finely divided materials of low as well as high specific surface areas, in the low pressure range of less than 1mm Hg at -196 C. The apparatus handles four samples at a time. The use of a thermistor in measuring the low pressures to a high accuracy offers several advantages over conventional methods of measurement. The adsorption isotherms were used to calculate the specific surface areas of powders by the B.E.T. method. The applicability of the Harkins-Jura equation for the determination of the surface areas was also investigated. It is concluded that both the B.E.T. and the Harkins and Jura methods are applicable for the determination of low surface areas of solids by the Kr gas adsorption method; however, the value for the compressibility constant must be indirectly evaluated to use the Harkins and Jura method. The use of thermistors in measuring pressures, which is presently a matter of a few seconds for each reading, eliminated the cumbersome and time-consuming process of using the McLeod gauge throughout the experiment. The average volume of dead space is known within 2%, an error which may originate from the McLeod gauge calibration. The error in calibration of pressures against the off-balance potential (Voff), using the McLeod gauge, usually arises at low and high values of pressure; this error can be considerably reduced by making only one or two accurate measurements with the McLeod gauge at a moderate pressure. With reference to this pressure, the gas burette can then be used for the rest of the calibration of pressure against Voff.

5637 APTIC NUMBER 15838

Albert, R.
DESIGN OF A GASEOUS DIFFUSION URANIUM HEXAFLUORIDE ISOTOPIC CONCENTRATION EXPERIMENTAL LINE. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:412-417.

An experimental line of cells and other equipment for the isotopic concentration of uranium hexafluoride by gaseous diffusion is described; the technical characteristics of the line are given along with a process flowsheet. Equipment was selected on the basis of resistance to corrosion by hydrofluoric acid and tightness. Because of resistance to corrosion, the basic equipment material is a very low-carbon type of austenitic stainless steel, with molybdenum added, or a grade of high-aluminum light alloy steel. Maximum tightness is necessary to preserve the purity of UF6 and to insure plant safety. The early starting date set for the line required a delivery schedule that led to many compromises in choice of methods and equipment. The pilot plant installation was designed to permit flexibility in making even substantial changes in operations in the shortest possible time and to allow for consideration of applying the design to possible future commercial plants. Descriptions are given of the principal equipment: the compressors, diffusers, heat exchangers, and valves and fittings, as well as considerations of line control and measurement techniques. The tightness of the system when tested in operation was found, in general, to be excellent.

5638 APTIC NUMBER 18780

Alexieev, B. A., S. P. Bulygin, P. S. Chernorotov, B. A. Panin, G. K. Shoheptin, and V. S. Zolotarev
ISOTOPE SEPARATION OF RARE-EARTH ELEMENTS BY THE ELECTROMAGNETIC METHOD. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:465-470. 7 refs. (Translated from Russian).

To overcome the scarcity and high cost of using pure initial substances as a working medium in the isotopic separation of rare-earth elements by electromagnetic methods, the substitution of the much cheaper concentrates of these elements was investigated under actual plant conditions. A convenient mutual distribution of isotopes of some rare-earth elements is given that makes it possible to avoid complete purification of the initial substance from accompanying rare-earth elements. After the electromagnetic separation, the comparatively easy task of chemical separation of relatively simple mixtures can be carried out by conventional methods. Since the weight quantities of such mixtures for each isotope to be separated are considerably less than those of the initial substance, this purification is a laboratory procedure, whereas preparation of the required quantity of pure material requires the use of industrial ion-exchange devices. The harmful effect of impurities on the uniformity of evaporation of the working medium when concentrates are used is small, due to the proximity of the vapor pressures of chlorides of various rare-earth elements, although some fractionation during the evaporation of concentrates was observed. The methods and data of two experimental examples are given: the isotope separation of gadolinium from its 63% concentrate, and of neodymium from concentrates of various composition. It is concluded that for the separation of the rare-earth and scarce elements, the use of concentrates as an initial material is possible and justified, and significantly decreases the costs and scale of engineering operations. Use of concentrates also makes it possible to carry out simultaneously the isotopic separation of the accompanying elements.

5639 APTIC NUMBER 13898

Alimarin, I. P. and G. A. Perezhogin
SUBSTOICHIOMETRIC SEPARATION IN ACTIVATION ANALYSIS. EXTRACTION OF CO-ORDINATIVELY-UNSOLVATED SALTS. TALANTA, 14(1):109-119, Jan. 1967. 13 refs.

The necessary conditions for the use of extraction of coordinatively unsolvated salts for substoichiometric separations in activation analysis were studied. Particular attention was paid to the influence of interfering ions and concentration of the carrier. A study was made of the substoichiometric extraction of halide ions, oxyanions, and anionic metal complexes by means of the tetraphenylarsonium ion into chloroform and dichloroethane, and of the extraction of alkali metal ions into nitrobenzene with tetraphenylborate. Substoichiometric separation combined with neutron-activation analysis was much easier and faster than any method previously used. The new method seems promising for the separation of iodine, cesium, rubidium, thallium, chromium, tantalum, and other metals. (Authors' summary modified)

5640 APTIC NUMBER 14508

Allen, J. A. and A. J. Clark
THE REACTION OF OXYGEN WITH METALLIC CHLORIDES. J. Appl. Chem. (London), vol. 16:327-332, Nov. 1966. 17 refs.

The reaction of oxygen with the solid chlorides of copper(I), copper(II), magnesium, and yttrium was examined at temperatures in the range of 200-450 deg and at pressures below 20 cm Hg in order to clarify the behavior of the chlorides in Deacon and oxychlorination catalysts. Copper(II) chloride does not adsorb or react with oxygen, but copper(I) chloride readily reacts to form CuO, CuCl2, or a mixture of the two. Both magnesium and yttrium chlorides react to form their respective oxides. For magnesium chloride, the reaction proceeds without limit except at 450 deg, the extent of reaction approaches a limiting value for yttrium chloride. The results are related to energetic criteria previously proposed for these catalysts. The possible need to achieve physical dispersion of the copper(I) chloride in these systems and to include only components which exhibit limited, rapid oxygen saturation are indicated. (Author abstract modified)

5641 APTIC NUMBER 15221

Ambler, Charles M.
THEORY-THE FUNDAMENTALS OF SEPARATION, INCLUDING SHARPLES 'SIGMA VALUE' FOR PREDICTING EQUIPMENT PERFORMANCE. Ind. Eng. Chem., 53(6):430-433, June 1961. 8 refs.

The fundamentals of separation in centrifuges are discussed and equations are derived for predicting equipment performance. The ultracentrifuge permits the observation and measurement of sedimentation velocities and equilibria and can be used for the determination of molecular shapes and weights as low as a few hundred of even very labile molecules in their natural environment. Centrifugal force applied to vapor phase systems permits the concentration and partial separation of gases of very low molecular weight differences. Industrial centrifuges are conventionally used for the resolution of multiphase systems. They develop up to 16,500 times the force of gravity. The sedimentation-type centrifuge has only two basic configurations: the tubular and the disk. The batch automatic centrifugal filter is designed to process a unit charge through the required cycle and repeat this cycle automatically on successive charges. It capacity is directly proportional to the size of the unit charge and inversely proportional to the time required for each cycle. Portions of the cycle that vary with the process considerations are screen rinse time, feed or loading time, cake rinse time, and dry spin time. The screen rinse usually includes an experience factor. The other portions can be accurately evaluated from test data on any other basket centrifuge operated at the relative centrifugal force of the proposed unit.

5642 APTIC NUMBER 18678

Ammann, P. R. and R. S. Timmins
CHEMICAL REACTIONS DURING RAPID QUENCHING OF O2-N2 MIXTURES FROM VERY HIGH TEMPERATURES. Preprint, Combustion Institute, Western States Sect., 25p., 1965. (Presented at the Combustion Institute, Western States Section, Spring Meeting, Hollywood, Calif., March 1965.)

A model was developed to study chemical reactions which occur in O2-N2 mixtures during very rapid cooling in small diameter tubes. The system considers both homogeneous gas phase reactions and surface reactions based upon a simplified mass transfer mechanism. Using an energy balance to determine the rate of quenching, the mole fractions of N2, O2, NO, N, and O were calculated as a function of temperature. In these studies, air and an equimolal O2-N2 mixture were cooled from temperatures between 3000 and 7300 F. It was concluded that the one-dimensional model contributes to an understanding of chemical behavior of gases during very rapid quenching from very high temperature. These calculations also are important for predicting the economic potential of chemical-arc processes. The chemical reaction mechanisms which occur during very rapid quenching of high-temperature air are quite complicated. The composition of the quenched gases is determined jointly by a number of factors which include the initial temperature and composition, the time-temperature history of the gas, probe diameter, pressure, and reactivity of the probe surface. The product composition of O2-N2 gases which are quenched rapidly from very high temperature is not directly related to the equilibrium composition at the initial temperature. (Author summary modified)

5643 APTIC NUMBER 14806

Antisari, Ottavio Vittori and Vittorio Prodi
THE SCAVENGING OF ATMOSPHERIC PARTICLES BY ICE PHASE. Consiglio Nazionale Delle Richerche, Rome, Italy, Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Report NDP 8, 36p., May 1966. 24 refs.
CFST:N6918828

The ability of ice crystals growing in supercooled clouds to collect and include foreign particles in their structure was examined in a Nakaya chamber. The experiments confirmed the existence and the behavior of 'dust free space' around evaporating surfaces and indicated the complexity of the phenomenon. Ice crystals have the capability of incorporating foreign particles during their growth. The capture occurs mainly in the growing branches of the crystals. Quantitative evaluation shows that the capture efficiency of an ice surface growing in supercooled cloud is more than one order of magnitude higher than the capture efficiency of condensing water. Assuming that the Stefan flow is the main capture mechanism during condensation, the higher efficiency of ice can be explained by the dust free space around evaporating droplets which represents the region in which the anology between Stefan flow and the flow of particles does not hold. (Author conclusions modified)

5604

APTIC NUMBER 15281

Antonini, Fraldo
KINETIC STUDIES ON HOMOPROTEINS BY FLASH PHOTOLYSIS. Rome Univ. (Italy), Instituto di Chimica Biologica, Grant AF EOAR 68-0008, Final Rept. AFOSR 69-0809TR, 5p., Jan. 31, 1969. 3 refs.
AD 683715

The reaction kinetics of CO-heme with apoperoxidase were studied in a rapid mixing-flash photolysis experiments. It was found that the combination of CO-heme with apoperoxidase is a very fast process. The compound formed was combined with CO and it was found that after a few milliseconds, the kinetics of the CO reaction are the same as that of natural peroxidase. Myoglobins reconstituted from globins and hemes differing from protoheme in the side chains 2 and 4 of the porphyrin were obtained, and the kinetics of the reaction of myoglobin with CO were studied. The rate constants for combination with CO of proto-, meso-, and deuteromyoglobin are in the ratio of 1:1:3 for the products obtained from whale myoglobin. The reconstituted products from Aplysia myoglobin gave rates corresponding to the ratios of 1:1:50. Thus, the effect of substituting hemes differing from protoheme depends on the type of protein used in the reconstitution. The rates of combination of the isolated chains of human hemoglobin with oxygen were also measured by flash photolysis and stopped-flow methods. A significant discrepancy was noted in the association rates in the case of the beta chains. The functional properties of a hemoglobin carrying only heme on the alpha chains were investigated. The protein showed nearly hyperbolic oxygen equilibrium curves with 3-10 times higher oxygen affinity than normal hemoglobin, depending on the pH. The Bohr effect is present but is about one-half that of normal hemoglobin. The oxygen binding behavior of the hemerythrin of Sipunculus nudus was studied. The oxygen equilibrium showed only a slight site-site (homotrophic) interaction; there was no Bohr effect. The dissociation of oxyhemerythrin in the presence of sodium dithionite does not adhere to strict first-order kinetics but tends to slow down as the reaction proceeds.

5605

APTIC NUMBER 10388

Antonishin, N. V., V. A. Borodulya, A. M. Gulyuk, S. S. Zabrodskiy, and V. A. Nemkovich
COMBUSTION OF LIQUID AND GASEOUS FUELS IN A FLUIDIZED BED OF FINE-GRAIN MATERIAL AND UTILIZATION OF HEAT FROM THE EXHAUST GASES. (O szhiganii zhidkogo i gazoobraznogo topliva v psevdoozhizhennom sloye melkozernistogo materiala i utilizatsii tepla ukhodyashchikh gazov). Text in Russian. Fiz. Goreniya, Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb., 1966:20-25.

Experimental studies were made of the combustion of liquified propane-butane, and of solar oil in fluidized beds at the Institute of Heat and Mass Exchange of the Belorussian SSR Academy of Sciences. Gas combustion studies were made with quartz sand particles graded at 0.2-0.6 and 1.4-2.0 mm in a 75-mm diameter tube and in a 0.04 sq m chamber. Bed height was 120-200 mm and maximum temperature occurred at a height of 30-70 mm. A bed temperature of 850-1000 C gave sufficiently complete combustion with an air excess of 1.05-1.2. Liquid combustion studies were made with Dinas brick fragments graded at 2-3, 3-5, and 5-7 mm in 75- and 100-mm diameter tubes. An air excess of 1.4 in the 75-mm tube gave 96-97% combustion, and an air excess of 1.15 in the 100-mm tube gave 98.1% combustion. The experimental data are used in proposing a theoretical scheme for recovering heat from exhaust gases by circulating the material of the fluidized bed so as to pass incoming air through it for preheating.

5606

APTIC NUMBER 15461

Apelblat, Alexander and Gideon Pery
TOTAL FLOW RATES IN AN ISOTOPE SEPARATION SYSTEM. Ind. Eng. Chem. Fundamentals, 3(1):83-85, Feb. 1964. 6 refs.

It is possible to express a material balance at any intermediate stage using Cohen's cascade theory for the ideal and square cascades. The special case of a cascade working with a constant cut number and with losses was considered by Deshuphande and Gami and without losses by Turkin. The flow rate in every stage was obtained by the stage-to-stage calculation method. The disadvantage of this method is that, to determine a material balance in the K-th stage, it is necessary to use K-1 mathematical operations. In the present work, the direct formulas for a material balance in every stage are developed. The cascade for isotope separation, working with constant cut numbers and a given number of stages for a desired enrichment, is discussed. A simple general calculation of a material cascade balance in any intermediate stage is presented as a simple function of the cut numbers. For isotope separation in low concentration and without losses, the enriched cut number gives a maximal thermodynamic efficiency and a minimal total flow rate.

5607

APTIC NUMBER 10588

Arii, K.
SORPTION OF SO2 BY ACTIVATED CARBON V. (Kassei tanso ni yoru SO2 no kyuchaku V). Text in Japanese. Rikagaku Kenkyusho Iho (Bull. Inst. Phys. Chem. Res., Tokyo), 14(2):99-114, 1935. 2 refs.

The mechanisms of adsorption and absorption of SO2 by activated carbon were studied. Activated carbon (0.1628g) was exposed to SO2 gas, and its weight change was measured using a spring balance made of melting quartz at a fixed pressure. The first experiment was started under the condition where the activated carbon was supersaturated only on the surface (adsorption) with SO2 without internal absorption following a short exposure (35 sec) to SO2 gas at 500 mm Hg. Thereafter, the SO2 pressure was reduced and kept for a long period between 167.7 and 21.8 mm Hg. The second experiment was started under the condition where the activated carbon was supersaturated both on the surface (adsorption) and internally (absorption) following a long exposure (more than 24 hrs) to SO2 gas at 780 mm Hg. Thereafter, the supersaturated carbon was placed in a vacuum

for 40 to 100 sec followed by re-exposure to the SO2 gas at 300 mm Hg. In both experiments, the presence of both adsorption and absorption was clearly proved by the change in weight of the activated carbon.

5648 APTIC NUMBER 10689

Arii, K.
SORPTION OF SO2 GAS BY ACTIVATED CARBON VI. (Kassei tanso ni yoru SO2 no kyuchaku. VI). Text in Japanese. Rigakaku Kenkyusho Iho (Bull. Inst. Phys. Chem. Res., Tokyo), 14(2):1210-1232, 1935. 4 refs.

Velocities of sorption and desorption of SO2 gas by activated carbon were observed at fixed pressure. A 0.2458 gram sample of activated carbon was exposed to SO2 gas at 200, 400, and 600 mm Hg and at temperatures of 20, 30, and 40 C, respectively, and the weight change of the carbon was measured for each set of conditions using a spring balance made of melting quartz. Equations relating amount of sorption to time were derived.

5649 APTIC NUMBER 15120

Arregger, J. P.
PRODUCTION AND PURIFICATION OF ARGON. Chem. Process Eng., 45(10):549-554, Oct. 1964. 1 ref.

Argon is commercially important because it is completely unreactive chemically and because it is comparatively abundant in relation to the other inert gases; its major industrial applications are welding, filling of electric light bulbs, and semi-conductor manufacture. The most important process of argon manufacture is based on the air-separation plant with the argon side-arm column producing crude argon, which can then be purified in a separate refining plant. Alternatively, argon can be recovered from the ammonia synthesis loop purge, or from the column bottoms of a nitrogen wash plant. Recently-developed closed-cycle purification plants, in which argon is recirculated to a series of usage points, are also described; this type of plant has particular utility where a very small portable unit is required which can be used to supply a number of alternative usage points as required. On a large scale, economic factors require the use of a cryogenic type of plant. Analysis of argon from air-separation plants is largely a matter of the determination of oxygen and nitrogen. For oxygen analysis, the use of an electrochemical cell of the Hersch type is well-established. Nitrogen determination is much more difficult; the most important methods available are thermal conductivity measurements, mass spectrometry, and use of an ion mobility analyzer. The use of an ion mobility analyzer is recommended for plant control purposes. Present practices in the handling, storage, and transport of argon are described; the primary considerations are to prevent contamination and losses of the gas.

5650 APTIC NUMBER 15431

Ash, R., R. M. Barrer, R. B. S. Pope, and C. G. Pope
FLOW OF ADSORBABLE GASES AND VAPOURS IN A MICROPOROUS MEDIUM. I. SINGLE SORBATES. Proc. Roy. Soc. (London), Ser. A, vol. 271A: 1-33, Jan. 1, 1963. 18 refs.

Adsorption and flow measurements were made in a microporous membrane of a consolidated, high specific area, gas-sorbing carbon. The gases and vapors studied were SO2, CO2, N2, Ar, and He over a range of temperatures and pressures. Steady-state permeation rates showed that in the membrane used, for the vapors SO2 and CO2, and for N2 and Ar at liquid oxygen and nitrogen temperatures, flow is dominated by the flux of the adsorbed film. Even for nitrogen at 190 K, adsorbed flow is considerably larger than gas-phase flow. From the results, surface diffusion coefficients were evaluated which are characteristic functions of the amount adsorbed. The properties of these diffusion coefficients are considered in relation to the pore structure and the coverage of the surface by adsorbate. Microporous septa of appropriate pore characteristics can give very large separations and can become effective semi-permeable membranes, able under suitable conditions of temperature and pressure to transmit condensable, strongly sorbed species while not transmitting non-sorbed species. This behavior depends upon complete blockage of gas-phase flow by adsorbate. Such blockage can occur well before complete saturation of the pores at the ingoing face of the medium, owing to preferential filling of bottlenecks in the flow channels. The transient state time-lags is considered. Using the method of Frisch, it did not prove possible to represent these time lags-in terms of the steady-state diffusion coefficients, thus emphasizing the distinction between transient and steady-state diffusion in heterogeneous media.

5651 APTIC NUMBER 10872

Astarita, Giovanni
REGIMES OF MASS TRANSFER WITH CHEMICAL REACTION. Ind. Eng. Chem., 58(8):18-26, Aug. 1966. 56 refs.

Asymptotic solutions of the differential equations of mass transfer with a chemical reaction can be derived without any specific assumption concerning the kinematics of motion of the phase in which reaction takes place and without any assumptions regarding the reaction kinetics. Five basic regimes (or asymptotic solutions of the pertinent differential equations) are given. Simple rules are stated by means of which any specific process can be identified as approaching the conditions of any one of these five regimes. The rules are in the form of inequalities which need to be largely and not only barely fulfilled. Thus, specific processes may take place in transition conditions. The kinetic regime involves a process when the reaction rate is so low that essentially all of phase 2 becomes saturated with the transferring component and may arise under slow-reaction and fast-reaction conditions. A process is said to proceed in the diffusional regime when the reaction rate is low enough not to interfere with the diffuse process but at the same time is fast enough to consume all of the transferring component fed by diffusion process in the bulk of phase 2. The fast reaction regime involves a process proceeding if fast reaction conditions prevail

and the concentration in the bulk of phase 2 is kept at its equilibrium value. The instantaneous reaction regime is found when the reaction between the transferring component and some reactant initially present within phase 2 is instantaneous, so that at no point within phase 2 can the two reactants coexist at non-negligible concentration levels. A process said to proceed in the surface reaction regime when the reaction takes place essentially at the interface, so that the transferring component does not actually enter phase 2. It was suggested that asymptotic forms of relevant equations and analytically simple interpolation formulas can be used with some degree of confidence also under conditions which are very different from the ones assumed in their derivation.

5652 APTIC NUMBER 13529

Atkinson, R. J., A. M. Posner, and J. P. Quirk
CRYSTAL NUCLEATION IN Fe(III) SOLUTIONS AND HYDROXIDE GELS. J. Inorg. Nucl. Chem., 30(9):2371-2381, Sept. 1968. 31 refs.

Iron (III) hydroxide gels were produced from a series of 0.5 molal Fe(III) nitrate solutions hydrolyzed for varying times and at pH values up to 1.5. The types and sizes of crystals produced by aging the gels at 60C in the presence of excess NaOH were examined qualitatively by electron-microscopy, selected-area diffraction and X-ray diffractometry. Acicular goethite crystals were nucleated in the gel by extremely small goethite crystals which had formed during slow hydrolysis in the parent iron solution. Goethite crystals occurred as cruciform twins showing an apparent (021) twin plane when epitaxial growth commenced on nuclei which were extremely small crystals of hematite formed during very rapid hydrolysis at precipitation. Depending on conditions of pH, the hematite nuclei grew to hematite, to hematite with epitaxial growths of goethite, or to twinned goethite crystals apparently free of hematite.

5653 APTIC NUMBER 15895

Atroshchenko, V. I., G. K. Goncharenko, and S. G. Sedasheva
KINETICS OF ABSORPTION OF NITROGEN DIOXIDE BY SOLID CALCIUM OXIDE. (Kinetika vbirannya dvookisu azotu tverdim okisom kal'tsiyu). Text in Ukrainian. Khim. Prom. Inform. Nauk Tekh. Zb., no. 1:27-29, Jan.-March, 1965. 1 ref.

Experimental study of the absorption kinetics for 10% nitrogen dioxide over solid calcium oxide was made at 50-300 C. The absorption rate constant at these temperatures ranged from 0.0572 to 0.572, while the corresponding degree of absorption increased from 7.3 to 46.5%. These values were determined at 7-9% saturation of the absorbent, which occurred in 0.191-0.107 sec. Reducing NO2 concentration to 5% resulted in a 10-20% reduction in the degree of absorption. This reaction is recommended for production of calcium nitrate fertilizer.

5654 APTIC NUMBER 13530

Ayen, R. J. and M. S. Peters
CATALYTIC REDUCTION OF NITRIC OXIDE. Ind. Eng. Chem., Process Design Develop., 1(3):204-207, July 1962. 9 refs.

The reaction between nitric oxide and hydrogen was studied at 375,400 and 425 C and 0.005 to 0.05 atm. Temperature measurements were made with thermocouples and a potentiometer. Two important reactions were noted: One mole of nitric oxide and one mole of hydrogen form one mole of water and one-half mole of nitrogen in an equilibrium reaction, and two and one-half moles of hydrogen and one mole of nitric oxide form one mole each of water and ammonia in an equilibrium reaction. Mechanisms were developed for these reactions, and rate and adsorption constants were evaluated from the data for the corresponding rate equations. The controlling mechanism for the first reaction is the combination of one mole of each adsorbed reactant to form water and atomic nitrogen, either directly or through intermediate steps. Hydrogen dissociation appears to be the controlling mechanism in the second reaction. The study's implication for smog-control programs is suggested.

5655 APTIC NUMBER 15133

Aylmore, L. A. G. and R. M. Barrer
SURFACE AND VOLUME FLOW OF SINGLE GASES AND OF BINARY GAS MIXTURES IN A MICROPOROUS CARBON MEMBRANE. Proc. Roy. Soc. (London), Ser. A., 290(1423):477-489, March 15, 1966. 14 refs.

Surface and volume flow were studied in a microporous carbon membrane of high surface area for He, Ar, N2, Kr, and CO2, and for the mixtures Kr-N2 and CO2-Kr. Although the adsorption extended beyond the range in which Henry's law was valid, the permeability coefficient was also identical for the pure gas and for the gas in binary mixtures in which competitive adsorption was occurring. These results indicate that surface flow occurred by a random walk diffusion mechanism, rather than by a viscous flow mechanism. The products of the permeability coefficient times the square root of the molecular weight show smooth correlations with parameters determining the adsorbability of the flowing gases. (Author abstract modified)

5656 APTIC NUMBER 15198

Baddour, Raymond F., Alan S. Michaels, Harris J. Bixler, Richard P. De Filippi, and James A. Barrie
TRANSPORT OF LIQUIDS IN STRUCTURALLY MODIFIED POLYETHYLENE. J. Appl. Polymer Sci., 8(2):897-933, 1964. 20 refs.

The mechanism responsible for changes in film properties was investigated and the structural aspects of a crystalline polymer that affects liquid sorption and diffusion were determined. Cast linear polyethylene films subjected to dry and solvent annealing display markedly different sorption and diffusion barrier properties than do untreated films. The subsequent sorption of liquid o- and p-xylene and cis- and trans-acetylene dichloride per unit volume of amorphous polymer increases as the annealing temperature and/or treating solvent concentration increases. Integral diffusivities calculated from sorption and

steady-state permeation rates show a monotonic increase with sorption per unit volume of amorphous polymer. The concentration dependence, however, is less marked than observed in similar systems at low permeant activity. Apparently the treatment reduces the effective crosslinking imposed by the crystallites on the amorphous polymer chains through disentangling and incorporating some of these chains into crystallites. Thus the polymer is capable of a greater degree of swelling when brought into contact with a compatible liquid in spite of a higher degree of crystallinity. The low concentration dependence of the diffusivities is probably due to heterogeneous distribution of excess permeant in a treated film. If the excess permeant were preferentially sorbed in regions of low polymer concentration, then the above observations could be explained. Long-duration, osmotic stress-induced swelling and recrystallization are cited to account for time-dependent permeation rates in treated and untreated films. (Author summary modified)

5657 APTIC NUMBER 15069

Bailey, C. R., A. B. D. Cassie, and W. N. Angus
INVESTIGATIONS IN THE INFRA-RED REGION OF THE SPECTRUM. PART VI. THE ABSORPTION SPECTRUM OF SULPHUR DIOXIDE. Proc. Roy. Soc. (London), Ser. A, 130(812):142-156, Dec. 2, 1930. 12 refs.

The infrared absorption spectrum of sulfur dioxide was re-examined in the 1-22 micron region with a prism spectrometer fitted with quartz, fluorite, rocksalt, and sylvine prisms. The spectrometer was carefully calibrated and allowance was made for the change in dispersion of the prism materials with temperature. Results are believed to be accurate to plus or minus 0.001 microns. The obtained spectrum was compared to one previously reported by Coblentz and satisfactory results were obtained. The partial resolution effected in most of the bands rendered possible the determination of a number of molecular constants, in particular the size and shape of the molecule, the moments of inertia, and the fundamental vibrational frequencies. The infrared spectrum was correlated with the Raman spectrum of sulfur dioxide. (Author summary modified)

5658 APTIC NUMBER 13736

Baker, W. R.
X-RAY DIFFRACTION ANALYSIS OF BROKEN HILL DUSTS. Proc. Aust. Inst. Min. Met., no. 228:23-29, Dec. 1968. 8 refs.

The problems of using comparatively simple x-ray diffraction equipment for quantitative analysis are examined. Internal standard and direct calibration procedures based upon the measurement of integrated diffraction energy (diffractometer peak area) have been developed for the determination of quartz in Broken Hill, N. S. W., dusts. By these methods an accuracy of plus or minus 10% of the true value can be obtained, and this can be improved to plus or minus 2.5% by statistical methods if necessary. Rapid analysis for the components quartz, muscovite, rhodonite, galena, fluorite, sphalerite, calcite, and garnet has been developed by adaptation of direct calibration procedures and use of maximum diffraction energies (diffractometer peak height). Until more is known about the pathological effects of multicomponent dusts of the Broken Hill type, it seems undesirable to fix their allowable concentrations in terms of the quartz content. (Author abstract modified)

5659 APTIC NUMBER 15198

Barrer, R. M.
NEW SELECTIVE SORBENTS: POROUS CRYSTALS AS MOLECULAR FILTERS. Brit. Chem. Eng., 4(5):267-270, May 1959. 66 refs.

The structure and action of molecular sieve sorbents are reviewed and possibilities are indicated for their large-scale use. A considerable number of alumino-silicates posses porous anionic frameworks. Some have intracrystalline cavities and channels filled with water; others have cavities filled with less volatile constituents such as salts. Certain structures have both water and non-volatile constituents together in the porous alumino-silicate framework. Expanded clay sorbents have great selectivity and can be made organophilic so that intersheet water is only relatively weakly sorbed and is easily removed. Although less stable to heating than gas-sorbing zeolites, these sorbents do not require high purging temperatures. Intercalated sorbates are normally readily removed. The molecular sieve method is well suited to handling bulk samples and for recovering or purifying substantial quantities of materials. Chief uses are in the field of hydrocarbon technology. The use of molecular sieve sorbents as dessicants is important on industrial and laboratory scales. Drying agents which act by adsorption include silica gel and activated alumina; in addition, chemical dessicants such as magnesium perchlorate and calcium sulfate may be employed. Gases can be dried by molecular sieve zeolites to give dewpoints below - 100 °. Gases which already have a low relative humidity are successfully dried even at 200 F. Moisture is thoroughly removed when the gas stream has a high velocity. Sieve crystals can be chosen so that other components of the gas stream are not sorbed. Porous crystals function as selective sorbents in three ways: the absence of any molecular sieve action, by partial molecular sieve action, and by total molecular sieve action. Separations of hydrocarbons, drying and super-drying of gases and liquids, and separation of permanent and noble gases by molecular sieve action are also discussed. A simple way of modifying the openness of molecular sieve and porous crystals is ion-exchange. Other modification procedures are described.

5660 APTIC NUMBER 15131

Barrer, R. M.
SOME PROPERTIES OF DIFFUSION COEFFICIENTS IN POLYMERS. J. Phys. Chem., 61(2):178-188, Feb. 1967. 62 refs.

Recent developments in sorption and diffusion in some polymers are reviewed. The five diffusion coefficients characteristic of any binary mixture can all be obtained in penetrant-polymer mixtures, but past measurements in a variety of systems have probably given erroneous diffusion coefficients (D) because it was only recently realized that the diffusion coefficients are

a function of times as well as of concentration. Present methods of interpretation cannot allow for simultaneous time and concentration dependence of D. For this reason the most reliable results refer to elastomer-penetrant systems, where time effects are at a minimum owing to short relaxation times of polymer molecules. For the same reason, in polymers exhibiting less chain mobility and stronger inter-chain bonds, the steady-state methods of measuring diffusion coefficients are preferable to transient state procedures. A classification of penetrant-polymer systems is given, with examples of each category. Factors influencing the concentration dependence of D are discussed, and also the experimental observations leading to the zone theory of the diffusion mechanism and the quantitative formulation of this theory. Relations between viscous resistance and diffusion are indicated, and generalized functional relationships are considered. Selectivity in the transmission of molecules through organic membranes is also considered. (Author abstract modified)

5661 APTIC NUMBER 15887

Barry, P. J.
EXCHANGE RATES OF RADIOACTIVE TRACERS BETWEEN THE ATMOSPHERE AND SNOW. Preprint. Atomic Energy of Canada Ltd., Chalk River, Ontario, Environmental Research Branch, 12p., March 1965. 8 refs. (Presented at Canadian Conference on Micrometeorology, 1st, Toronto, April, 1965.)
CESTI, APCL-2232

A new model of heat and mass exchange between air and natural surfaces is introduced, together with experimental data from which a new empirical relationship between exchange rate coefficients and measurable wind characteristics was found. Snow was used as the experimental system because the purely aerodynamic properties of the system can be studied without the uncertainties introduced by biological control of exchange rates occurring with vegetation. It was assumed that Reynold's analogy can be applied to that portion of the total drag due to skin friction. The model avoids the theoretical problems raised by the boundary layer theory. It is independent of atmospheric stability and is limited in practice only by difficulties of measuring the surface drag in conditions of extreme stability or instability. No assumptions were made about the detailed nature of the flow near rough surfaces. The simple model leads to an expression, the individual terms of which are related to one another in a physically logical way, and provides for a smooth progression of mass, heat, and momentum exchange from smooth to rough surfaces. Field tests were made with snow as the experimental surface. A simple correlation was found between the form drag coefficient and the Reynold's number of flow over a wide range of values. The model should provide a useful way of expressing the results of mass and heat transfer studies where surface to air fluxes and gradients are involved.

5662 APTIC NUMBER 15815

Bartholomew, Roger P.
A STUDY OF THE EQUILIBRIUM KNO3(l) YIELDS KNO2(l) PLUS ONE-HALF O2(g) OVER THE TEMPERATURE RANGE 550-750 DEG. J. Phys. Chem., 70(11):3482-3486, Nov. 1966. 13 refs.

Equilibrium constants for the reaction KNO3(l) yields KNO2(l) plus one-half O2(g) were determined. Both the change in volume of the system at constant oxygen pressure and the nitrite content were followed by analyzing the resulting equilibrium mixture. The heat capacities of molten potassium nitrate and potassium nitrite were measured as a function of temperature in order to calculate the heat of reaction. A value of 27.6 kcal/mole was found experimentally for the heat of reaction over the range 550-750 deg. Heat content data were obtained for liquid potassium nitrate and nitrite which led to a calculated value of 27.5 kcal/mole for the heat of reaction at 650 deg. The results are discussed in the light of the discrepancy existing in literature. The findings have particular implications for three areas where alkali metal salts are used at high temperatures: the treatment of steel, the strengthening of glass by ion exchange, and the field of munitions.

5663 APTIC NUMBER 14995

Barusch, M. R. and J. H. MacPherson
ENGINE FUEL ADDITIVES. In: Advan. Petrol. Chem. Refining. John J. McKetta, Jr. (ed.), vol. 10, New York, Interscience, 1965, Chapt. 10, p. 457-586. 215 refs.

A detailed discussion of antiknock agents is given, emphasizing data on such new antidetonants as methylcyclopentadienylmanganese tricarbonyl, tetraethyllead (TEL), and mixtures of methylethyllead alkyls. With one exception, only additives used in commercial fuels are discussed. The exception is the class of compounds known as lead extenders, i.e., compounds which enhance the effectiveness of lead alkyls by the formation of carboxylic acids in the combustion chamber of an engine. Their performance characteristics provide considerable insight into the mechanism by which antiknock agents operate. Other subjects covered include scavengers for lead, surface ignition suppressants, antioxidants, metal deactivators, rust-preventing additives, gasoline detergents, additives to prevent carburetor icing, diesel fuel detergents and dispersants, biocides, and additives to prevent the buildup of static electricity during fuel handling. In considering antiknock agents, the influence of fuel composition on TEL effectiveness and the antagonism of sulfur to TEL are discussed. A brief note on antiknock additives for aviation gasoline is included. (Author introduction modified)

5664 APTIC NUMBER 15060

Beams, J. W.
HIGH ROTATIONAL SPEEDS. J. Appl. Phys., 8(12):795-806, Dec. 1937. 101 refs.

Recent advances in the production of high rotational speeds are reviewed. With the exception of Svedberg's ultracentrifuge, most of these advances resulted from the use of one or a combination of the following devices: the air or gas bearing, the flexible shaft, and the oil or liquid sealed vacuum gland.

A general purpose apparatus that is suitable for spinning almost any size or shape of rotor in air or other gases at about atmospheric pressure is described; it has been used successfully for spinning small mirrors, in biological experiments where thermal equilibrium throughout the centrifuge is not essential, and for determination of molecular weights. Improved air-driven vacuum type ultracentrifuges are used to separate isotopes by evaporative centrifuging and in biochemical research. Applications of an inverted ultracentrifuge, in which the driving turbine, air cushion, supports, etc., are placed below rather than above the vacuum chamber, are also noted. A technique for spinning long vertical rods and tubes in a vacuum is reported. The rods and tubes are supported by flexible shafts above and below the rotor; their bursting strength is the only factor determining maximum rotational speeds. The most extensive use of air-driven vacuum type ultracentrifuge is in the concentration and purification of biological materials, they are also utilized for gas separations, velocity selection of molecules, and to study the strength of materials. Electrical, steam, and oil-driven ultracentrifuges are briefly considered, as is a promising new method for producing high rotational speeds in a vacuum or in gases at various pressures. This method involves the Holmes magnetic suspension.

5665 APTIC NUMBER 15185

Beams, J. W.
HIGH SPEED CENTRIFUGING. Rev. Mod. Phys., 10(4):245-263, Oct. 1938. 51 refs.

Recent advances in the experimental technique and theory of centrifuging are reviewed. Advances in technique are characterized by greatly increased rotational speed and centrifugal force and by the elimination of stirring in the centrifuge bowl. The first improvement increases the rate of sedimentation, while the second raises the efficiency of separation to the theoretical value. The increase in rotational state and centrifugal force was primarily achieved by radical changes in methods of mounting and driving the centrifuge. Stirring is prevented by the elimination of vibrations, accelerations, and decelerations of the centrifuge and by maintaining the material being centrifuged at a uniform temperature. Six types of centrifuges are described: the pioneer Svedberg ultracentrifuge; air-driven centrifuges; vaccum-type air-driven centrifuges; the vacuum-type tubular centrifuge, developed to overcome limits on the quantity of material which can be centrifuged per unit of time; and the axially magnetically suspended centrifuge. The theory of sedimentation in ideal dilute solutions is developed. Applications of high speed centrifuging for measuring the size and mass of particles and molecules in the fields of medicine and biology are described. Emphasis is put on studies of the molecular weight of proteins; the concentration and purification of biological materials in quantities large enough for experimentation, and studies of the living cell. Isotopic separation of gases and vapors by centrifuging is also considered.

5666 APTIC NUMBER 15463

Beams, J. W., J. P. Snoddy, and A. P. Kuhlthau
TESTS OF THE THEORY OF ISOTOPE SEPARATION BY CENTRIFUGING. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd Geneva, 1958, vol. 4:428-438. 16 refs.

Three methods were employed to test the general theory of Cohen and others of isotope separation by centrifuging; most of the tests were made on the separation of the uranium isotopes in uranium hexafluoride (UF6). In the evaporative method, the substance containing the isotopes evaporates near the periphery of a spinning centrifuge rotor, diffuses along the centrifuge radius against the centrifugal fields, and passes out through a hollow shaft. The fraction drawn off along the axis has the lighter isotope enriched, while the residue in the rotor has the heavier isotope enriched. Experimental theory, methods, and data are given; the values obtained were in good agreement with the theory. The concurrent or 'flow through' centrifuge method consists of introducing the mixture to be separated in one end of a tubular centrifuge and collecting it in two separate fractions at the other end. It permits a greater range of variation of experimental conditions than the evaporative method and allows axial flow, as well as radial flow and diffusion, to take place. The separations obtained with this method were in excellent agreement with the theory. In the countercurrent centrifuge method, thin concentric streams of UF6 flow in opposite axial directions instead of in the same direction, enriching the inner stream in the lighter isotope at one end of the spinning tube and the peripheral stream in the heavier isotope at the other end. Because of the axial flow, a concentration gradient is set up along the length of the tube which is limited only by back diffusion; therefore, the separation may be many times that produced by the simple centrifugal process. Two variations of this method were tested; one in particular produced values in excellent agreement with the theory. It is concluded that the theory may be used for estimating isotope separation in the centrifuge with considerable confidence.

5667 APTIC NUMBER 15063

Beams, J. W. and C. Skarstrom
THE CONCENTRATION OF ISOTOPES BY THE EVAPORATIVE CENTRIFUGE METHOD. Phys. Rev., vol. 56:266-272, Aug. 1, 1939. 19 refs.

The air-driven vacuum-type tubular centrifuge was used for the separation of the isotopes of chlorine by the evaporative centrifuge method. The separations obtained were about the same as predicted by the theory provided that experimental conditions approximately conformed to the assumptions of the theory. With a steel tube 11 in. long and 3 in. inside diameter, containing baffles to prevent remixing, and spinning at 1060 rps, carbon tetrachloride vapor was withdrawn from the axis at the rate of 1.2 grams per minute without decreasing the separation factor. This separation factor for chlorine, which at any instant is the ratio at the periphery, was 1.025 in the above case. It is believed that the method is practical in the case of the heavier elements, but inferior to other centrifuge methods where large concentrations of the isotopes in smaller quantities of material are used. (Author abstract modified)

5668

APTIC NUMBER 15260

Beams, J. W. and F. B. Haynes
THE SEPARATION OF ISOTOPES BY CENTRIFUGING. Phys. Rev., vol. 50:491-492, 1936. 7 refs.

The feasibility of separating isotopes with an air-driven centrifuge was studied. A gas centrifuge was developed in which the gas enters through holes in the periphery and is pumped out at the center of the rotor through a tube which is used both to drive and support the rotor. To check the relative efficiency of the two rotors, one with a horizontal cross section and the other with a triangular cross section, experiments were carried out on the separation of a mixture of N2 and CO2 at room temperature. The results obtained are in fair agreement with theory. The rate at which a gas can be centrifuged depends on the design and speed of the rotor and the temperature, viscosity, and density of the gas. Dependence of the separation factor on the difference between the weights of the isotopes, rather than on their absolute values, gives the centrifuge method a decided advantage over those methods which depend on absolute values in the case of heavier elements.

5669

APTIC NUMBER 10718

Beauseigneur, Georges
FUELS AND COMBUSTION PRODUCTS. COMBUSTION TEMPERATURE. HEAT LOSSES. (Combustibles et produits de combustion. Temperature de combustion. Pertes par chaleur sensible). Text in French. Rev. Gen. Thermique (Paris), 6(71):1435-1444, Nov. 1967.

At equal air excess, the temperature of combustion in the furnace and the loss of sensible heat to the chimney are directly related to the enthalpy of the combustion products, which only depends on temperature. The lower the specific heat of the combustion products with respect to the heat liberated during combustion, the greater will be the temperature of combustion, with better transmission of heat and less heat loss to the chimney. The derivation of a formula for determination of enthalpy is described in detail. The total energy contained in a fuel is represented by its maximum thermal power, defined as the quantity of heat liberated by complete combustion at the standard pressure of 760 mm Hg: Maximum Thermal Power equals Net Thermal Power plus 50H2 plus 6h, where H2 is the per cent by weight of hydrogen in the fuel and h is the per cent by weight of water in the fuel. The ratio of net thermal power to maximum thermal power, which depends essentially on the hydrogen content, is indicated in tabular form for various fuels. This ratio, which is equal to 1 for carbon and carbon dioxide, equals 0.84 hydrogen, 0.97 for solid fuels, 0.94 for liquid fuels, and 0.90 for gaseous fuels, such as methane, butane, propane, and natural gas.

5670

APTIC NUMBER 15106

Becker, E. W., W. Beyrich, K. Bier, H. Burghoff, O. Hagena, P. Lohse, W. Schuette, R. Turowski, and F. Zigan
A NOZZLE FOR SEPARATION PROCESSES. (Das Trenndueseverfahren). Text in German. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. O. C. Nier (eds.), New York, Interscience, 1958, Chapt. 48, p. 560-578. 4 refs.

Light molecules in an expanding jet of a gaseous isotopic mixture tend to accumulate in the peripheral portion of the gas. A nozzle is described which permits the jet to be split into a peripheral portion, enriched with the light component, and a core portion, enriched with the heavy component. The elementary separation factor reaches or even exceeds that of the membrane process. The basic features of the arrangement are demonstrated in a series of experiments with a natural mixture of Ar36/Ar40. It is shown that the effect can be explained in terms of pressure diffusion and ordinary diffusion. The economics of the process are also reviewed. The method seems to be of practical interest for the separation of uranium isotopes. (Author abstract modified)

5671

APTIC NUMBER 15052

Becker, E. W., K. Bier, H. Burghoff, O. Hagena, P. Lohse, W. Schuette, R. Turowski, and F. Zigan
SEPARATION OF THE URANIUM ISOTOPES BY THE NOZZLE PROCESS. United Nations, New York, U. N. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:855-857. 3 refs.

A separation element for UF6 was designed to initiate systematic studies on the separation of the uranium isotopes. Since only a single separating unit is involved, mechanical compressors for the recompression of the expanded uranium hexafluoride are not necessary. The separating unit consists of a slit type nozzle and a corresponding diaphragm mounted gastight on a plate which divides the separation chamber into two compartments that are connected with liquid air traps. The gaseous uranium hexafluoride streams from the storage pipette into a separation unit. The feeding pressure is regulated with a valve and measured with a mechanical membrane gauge. The pressures in the compartments are adjusted by valves and are read on electrostatic membrane gauges. After an appropriate amount of UF6 passes through the nozzle, all the valves are closed. After heating the traps, the UF6 samples are frozen into the pipette which are weighed. The isotopic composition of the two samples is determined with a mass spectrometer. Experiments were conducted to find the optimum operating conditions. The specific ideal compression energy was found to be 1500 kwh/g mol. The weakest point of the nozzle process is the high suction volume of the compressors, which is due to the comparatively low operating pressure. On the other hand, the avoidance of porous membranes, which are apt to assure a higher degree of reliability, appears to be an advantage attached to the nozzle process.

5672

APTIC NUMBER 15010

Beenakker, J. J. M., G. Scoles, H. F. P. Knaap, and R. M. Jonkman
THE INFLUENCE OF A MAGNETIC FIELD ON THE TRANSPORT PROPERTIES OF DIATOMIC MOLECULES IN THE GASEOUS STATE. Phys. Letters, 2(1):5-6, Aug. 1, 1962. 6 refs.

Change in viscosity when the magnetic field is increased was previously assumed to be an effect limited to paramagnetic gases. This limitation is now shown to be not real; the influence of a magnetic field on the transport properties is common to nearly all diatomic gases. In general, a diatomic molecule has, even in the absence of a nuclear spin, a magnetic moment caused by its rotation. The change in the transport properties at saturation does not depend on the magnetic moment, but only on the non-sphericity of the molecule. However, the smallness of the rotational and nuclear magnetic moments leads to a lower precession-frequency so that higher magnetic fields and lower pressures are required to reach saturation for non-paramagnetic gases. Experiments with a capillary Wheatstone bridge performed on N2 supported the theory that even for non-paramagnetic gases, a magnetic field influences the transport properties.

5673 APTIC NUMBER 18627

Belen'kaya, T. M.
INVESTIGATION OF CATALYSTS OBTAINED ON A BASE OF ION-EXCHANGE MATERIALS. (Issledovaniye katalizatorov, poluchennykh na osnove ionoobmennykh materialov). Text in Russian. Issled. v Obl. Prom. Primeneniya Sorbentov, Akad. Nauk SSSR, Otd. Khim. Nauk, p. 208-211, 1961. 7 refs.

Permutite, an artificial zeolite, was activated with VO(II) ion from vanadium sulfate solution, and studies were made of its catalytic action in the oxidation of SO2 to SO3. Preparation of four different catalyst specimens is described and oxidation test data are tabulated. A maximum conversion of 97% is reported for a starting concentration of 13% with the reaction carried out at 450 C. It is concluded that catalytic activity derives from the presence of vanadium in the form of ions which have entered the aluminum silicate lattice. High thermal stability and mechanical strength, indifference to steam, and the absence of agglomeration point up the possibility of preparing industrial catalysts by ion exchange.

5674 APTIC NUMBER 18782

Berenyi, Ludwig
TESTING POLANYI'S THEORY OF ADSORPTION. (Pruefung der Polanyischen Theorie der Adsorption). Text in German. Z. Physik. Chem. (Leipzig), vol. 98:628-662, 1920. 13 refs.

A new method of calculation is presented for computing the distribution of adsorption potential in the adsorption space. Starting from experimental data or Van der Waals's equation valid above the critical temperature, this iterative method permits determination of the adsorption potential well below the critical temperature where compressibility can no longer be assumed. The method is explained by way of examples. The theory of Polanyi was tested and verified by using the experimental data of Titoff, Bomfray, Richardson, and Patrick on the adsorption of carbon dioxide, nitrogen, ethylene, carbon monoxide, methane, argon, and ammonia on charcoal, and of carbon dioxide, sulfur dioxide, and ammonia on silicic acid gel. The theory is also applicable to swelling gels.

5675 APTIC NUMBER 15494

Bergman, A. G. and E. Morozov
REACTION OF UREA WITH SODIUM AND POTASSIUM NITRATES. (Vzaimodeystviye mocheviny s nitratami natriya i kaliya). Text in Russian. Zh. Prikl. Khim., 36(8):1864-1867, 1963. 7 refs.

The binary system NaNO3-KNO3 and the ternary system CO(NH2)2-NaNO3-KNO3 were studied by the visual polythermal method. In the first case, it was established that, near a minimum temperature of 225 C, phases differing from the components crystallize with 46 to 50 mole % NaNO3. The crystallization surface of the ternary system consists of three basic fields: CO(NH2)2, NaNO3, and KNO3, which converge to a eutectic point at 76 C with the following composition: 72% CO(NH2)2, 8% KNO3, and 20% NaNO3. Polymorphic conversion of KNO3 at 127 C within the system was not detected.

5676 APTIC NUMBER 18865

Berlin, A., P. Manes, S. Forcheri, and C. Monfrini
DIFFERENCES IN THE MOBILITIES OF LIKE CHARGE IONS IN MOLTEN SYSTEMS. J. Phys. Chem., vol. 67:2505-2506, Nov. 1963. 17 refs.

Preliminary results obtained on ionic mobilities of cationic traces in alkaline earth halide melts and in NaNO3-KNO3 and NaNO3-KNO3-LiNO3 eutectics are reported. In countercurrent electromigration experiments of SrBr2 at 770-800 deg, the cationic migration of the strontium ion was appreciably faster than that of the calcium or magnesium ions, while the barium ions migrated faster in relation to strontium. In CaBr2 at the same temperature, the strontium and barium migrated faster and the magnesium ions migrated slower than the calcium ions. The preliminary results showed the great dependence of the ionic mobilities on the composition and temperature of the system. The observation of anionic migration for traces of certain metals strongly suggests that such ions form complexes in the melts. For binary mixtures having one ion in common and of approximately equal molar composition, the relative mobility of the two ionic species depends on the state of aggregation of the system. As the temperature increases, the aggregates disappear, and the ions can compete for other species in the melt to form complexes which will determine the migration velocity. It is likely that the smaller ions have a greater tendency toward the formation of complexes or toward aggregation. Increasing temperature has the tendency to dissociate the species. The mobility of the smaller cation should therefore have a larger activation energy leading to an eventual reversal of the mobilities.

5677 APTIC NUMBER 15086

Berman, A. S. and L. W. Lund
DEVIATIONS FROM CLASSICAL KINETIC THEORY IN THE LOW PRESSURE TRANSPORT OF GASES THROUGH POROUS MEDIA. United Nations, New York, Proc. U. N. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:359-365. 18 refs.

The flow of the five noble gases, helium, neon, argon, krypton, and xenon, through four porous samples, was precisely measured at low pressures and at several temperatures. The pore sizes of the samples were thousands of times greater than molecular dimensions and ranged from 1-240 microns. The pressure ranges studied were such that the mean free path ranged from 200-0.01 times the characteristic dimensions of the porous sample. The results showed surprising deviations from predictions based on conventional kinetic theory concepts. Contrary to these predictions, it was found that the transmission probability depends on both the gas and the temperature for those porous samples in which most of the gas molecules make collisions with the walls in their progress through the sample. Consistent significant deviations as high as 5% were observed. It was concluded that the transmission probability is gas- and temperature-dependent when wall collisions play a role in the transport. The effect is insensitive to changes in pore size in the range investigated. It is strongly indicated that the variation of the transmission probability is associated with the details of the gas-wall collision process. The data indicated that the transmission probabilities are lower than those which would be expected from kinetic theory considerations which assume diffuse scattering of atoms after a wall collision. No minimum was observed in the transport parameter with decreasing pressure. This confirmed the results of previous workers for the flow through porous disks and short capillaries. (Author summary modified)

5678 APTIC NUMBER 15008

Berne, Bruce J., Joshua Jortner, and Roy Gordon
VIBRATIONAL RELAXATION OF DIATOMIC MOLECULES IN GASES AND LIQUIDS. J. Chem. Phys., 47(5):1600-1608, Sept. 1, 1967. 62 refs.

The problem of vibrational relaxation of a diatomic molecule in a monatomic gas or liquid is considered in order to explore the relationship between vibrational relaxation and molecular rotations and translations. It was assumed in the linear approximation, that the perturbation Hamiltonian is determined by the force exerted on the oscillator coordinate by the medium. It was also assumed that quantum correlations are introduced by representing the autocorrelation function in terms of a classical autocorrelation function of an imaginary argument; and that the rotational kinetic energy autocorrelation function behaves like a Gaussian for short times and like an exponential for long times. Good agreement with measurement of gaseous systems was obtained. The treatment introduces a more realistic interaction Hamiltonian, thus leading to a general expression for the vibrational relaxation and rotational correlation times. This general result result can be applied to vibrational relaxation in gases and liquids. It was concluded that the results yield a simple theoretical justification for the energy-gap law for vibrational relaxation. The selection rules are straightforward. In the linear approximation, only transitions to adjacent states are allowed, in the same manner as dipole selection rules are concerned. Vibrational relaxation in nonassociated liquids should be characterized by relaxation times 2-4 orders of magnitude shorter than those in the gas phase at 1 atm pressure and at the same temperature, in view of the shorter rotational relaxation times in the liquid. In a solid, vibrational relaxation times may be very long because of hindered rotation.

5679 APTIC NUMBER 14863

Bertozzi, G.
SURFACE TENSION OF LIQUID ALKALI HALIDE BINARY SYSTEMS. J. Phys. Chem., 69(8):2606-2607, Aug. 1965. 4 refs.

Surface tension measurements using the Wilhelmy slide method are reported for twelve alkali halide binary systems having either a common anion or cation. Experimental results are shown to be well described by introducing the 'Tobolsky parameter', a function of interionic distances of the respective pure salts only. In systems with a common anion, a linear relationship holds between maximum deviations of surface tension isotherms from linearity and the Tobolsky parameter. In the case of alkali halide systems with a common cation, the numerical values of the Tobolsky parameter are very small because of the small difference between the ionic radii of chlorine and bromine. This prediction agreed with experimental data. It is apparant that only the sodium salts deviate slightly from linearity, whereas for the other cations, the isotherms are practically linear. The behavior of the sodium salts can be ascribed to the smallness of the cation, the electrical field of which can polarize the anions.

5680 APTIC NUMBER 14971

Bertozzi, G.
SURFACE TENSION OF LIQUID ALKALI HALIDE BINARY SYSTEMS. J. Phys. Chem., 69(8):2606-2607, Aug. 1965. 4 refs.

Surface tension measurements using the Wilhelmy slide method are reported for twelve alkali halide binary systems having either a common anion or cation. Experimental results are shown to be well described by introducing the 'Tobolsky parameter', a function of interionic distances of the respective pure salts only. In systems with a common anion, a linear relationship holds between maximum deviations of surface tension isotherms from linearity and the Tobolsky parameter. In the case of alkali halide systems with a common cation, the numerical values of the Tobolsky parameter are very small because of the small difference between the ionic radii of chlorine and bromine. This prediction agreed with experimental data. It is apparent that only the sodium salts deviate slightly from linearity, whereas for the other cations, the isotherms are practically linear. The behavior of the sodium salts can be ascribed to the smallness of the cation, the electrical field of which can polarize the anions.

5681 APTIC NUMBER 15269

Bestley, R., G. W. Cockett, and P. Parry
THE R.A.E.D.E. PORTABLE VISIBILITY RECORDER. Royal Armament Research and Development Establishment, Fort Halstead, England, Systems Div., R.A.E.D.E. Mem. 17/69, 6p., May 1969. 3 refs.

Portable equipment was developed to record variations in visibility when conducting field trials of night vision aids. The portable visibility meter is based on the measurements of the optical transmission of a standard light beam. The variation in the atmospheric transmission is measured by recording the apparent brightness of an incandescent filament lamp viewed over ranges which may be varied to suit the particular trial. The equipment was used successfully out to a maximum range of 1000 m. (Author summary modified)

5682 APTIC NUMBER 15888

Bikbisirov, R. S.
SOLUBILITY OF CESIUM NITRATE IN NON-AQUEOUS SOLVENTS. (Issledovaniye rastvorimosti nitrata tseziya v nevodynkh rastvoritelyakh). Text in Russian. Zh. Fiz. Khim., 37(10): 2356, 1963. 8 refs.

Experimental values for cesium nitrate solubility at 20 C are reported as follows (g/ml solvent): water, 20.43; methanol, 0.1850; ethanol, 0.0439; n-propanol, 0.0095; n-butanol, 0.0032; acetone, 0.00564; acetylacetone, 0.00402; methyl ethyl ketone, 0.00162; propionphenone, 0.00075; methyl acetate, 0.000594; ethyl acetate, 0.000386; n-butyl acetate, 0.000167; n-amyl acetate, 0.000208. An empirical formula for solubility is also presented.

5684 APTIC NUMBER 15268

Bilous, Oleab and Georges Counas
DETERMINATION OF THE SEPARATION FACTOR OF THE URANIUM ISOTOPES PRODUCED BY GASEOUS DIFFUSION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 9:405-411. 5 refs.

The separation factor is one of the fundamental data needed for the design of an industrial installation for isotope separation. A small pilot plant was built to measure the separation factor over a wide range of operating conditions. The plant includes 12 identical separation stages forming a cascade with constant transport, which is operated with total reflux between two end reservoirs. Each stage consists of a diffusion cell containing a porous separation barrier, a reciprocating pump with Teflon bellows that supplies uranium hexafluoride to the diffusion cell, and a water-cooled heat exchanger that cools the gas leaving the pump before it enters the diffusion cell. The auxiliary apparatus and possible adjustments of the system are described in detail. The various parameters of the operation can be chosen in the following ranges: pressure before the barrier between 10 and 50 cm Hg absolute; pressure beyond the barrier between 1 and 10 cm Hg absolute; compression ratio between 3 and 15; and temperature of the separators between 35 C and 85 C. The mass transport of gaseous UF6 at the inputs of the separating elements is of the order of 1 g/sec; the Reynolds number in the porous channel can be between 1000 and 6000. A series of equations is developed for the theoretical calculation of the separation factors for uranium isotopes. The pilot cascade separation apparatus demonstrates that these theoretical values can be obtained in practice. The tests with the apparatus have also given information on the aerodynamic behavior of such a cascade, and in particular on the effect of various parameters on the pressure distribution along the cascade.

5686 APTIC NUMBER 18877

Blaedel, W. J. and J. M. Strohl
CONTINUOUS QUANTITATIVE ELECTROLYSIS. Anal. Chem., 36(7):1285-91, June 1964. 14 refs.

The design and operation of a simple apparatus that can be used to electrolyze substances quantitatively in a flowing solution are presented. The continuous electrolytic cell consists of a short column packed with crushed graphite, which serves as an electrode for effecting various electrochemical processes. The graphite is in electrical contact with a counter electrode via a potential source and a low resistance solution path. Other packing materials, such as platinum and mercury-coated platinum, are cited as possibly being more suitable for certain applications. The general properties of the column are described, including contamination effects, useful potential range, effect of current on the cell's operation, changes in the acidity of the effluent, and the observance of electrolysis. The cell is packed with a conducting material whose potential can be varied, and only one packing material is necessary for a wide variety of tasks. Since the potential is applied from an external source, it is independent of the supporting electrolyte, and there is a wide choice of supporting electrolytes for use in a particular situation. Contamination of samples by the introduction of metal ions is less than in metal reductor columns. The cell can be used for tasks which cannot be performed by metal reductor columns, including oxidations and plating processes followed by stripping processes. At low concentrations, the selectivity of the cell approaches that of controlled potential devices, but selectivity decreases as the concentration of electroactive material increases.

5685 APTIC NUMBER 15508

Blanchard, J.
ADSORPTION OF SULFUR DIOXIDE BY ACTIVATED CARBON. (Adsorption de l'anhydride sulfureux par le charbon actif). Text in French. Ind. Chim. Belge, 20(Special):576-578, 1955. 17 refs.

The adsorption and desorption equilibria of SO2 on activated carbon were determined as functions of temperature between 0 and 200 C and of the SO2 concentration between 0 and 100% in a controlled atmosphere by means of a specially designed hydrostatic thermobalance. In addition, the proportion of sulfuric acid

formed on the activated carbon during the adsorption process was determined and was found to vary in direct proportion to the initial moisture of the carbon and the humidity of the controlled atmosphere. Acid formation became constant after a certain number of adsorption-desorption cycles. The results are represented in three graphs: the first consists of the curve of weight % of SO2 adsorbed on the carbon in an atmosphere of dry 100% SO2 at equilibrium as well as the curve of weight % of residual SO2 after desorption in dry air at various temperatures; the second is a group of curves of equal weight % of adsorbed SO2 at equilibrium vs. temperature and SO2 concentration in the controlled atmosphere; the third curve shows weight % of residual SO2 as a function of time and the number of adsorption-desorption cycles. It is concluded that activated carbon is an excellent concentrating agent for SO2. For example, with a 3% SO2 concentration in the controlled atmosphere, the adsorption curves show that 22 weight % of SO2 is adsorbed at 40 C, 25% at 30 C, and 28% at 20 C, while SO2 is readily desorbed at 200 C.

5686 APTIC NUMBER 15009

Blum, L.
THEORY OF UNIDIMENSIONAL MOLECULAR COLLISIONS. BROKEN BAR MODEL. J. Phys. Chem., 70(9):2758-2762, Sept. 1966. 16 refs.

A harmonic oscillator model for reactive chemical collisions is proposed. The model is solved rigorously for the reaction H2 + H yields H + H2. The results show the appearance of quite narrow resonance peaks for the reaction cross sections. (Author abstract modified)

5687 APTIC NUMBER 15008

Bocchini, M. and A. Mascanzoni
MORPHOLOGICAL AND STRUCTURAL EXAMINATION OF RED SMOKE POWDER. (Esame morfologico e strutturale di polveri da fumi rossi). Text in Italian. Met. Ital., no. 3:117-127, 1969. 4 refs.

Samples of red smoke powder were examined under optical and electron microscopes and by chemical analysis in order to determine the composition and crystalline structure of the trapped particles. The samples were taken from dust arresters of three types, characterized by the following procedures: (a) complete combustion of converter gas and wet condensation; (b) partial combustion combined with a regulated air draft and wet condensation; (c) complete combustion and dry condensation. Types (a) and (b) had a higher content of calcium ferrites and other impurities which were lacking with type (c). The type (c) dust arrester thus provides material that is commercially more desirable, in that the reclaimed iron ore is of a higher purity.

5688 APTIC NUMBER 14686

Bockris, J. O'M.
AN INTRODUCTION TO FUEL CELLS AND ELECTROCATALYSIS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 421-458.

Theoretically, natural gas conversion in an electrochemical engine (a combination of fuel cell and electric motor) should be twice that of the usual indirect method in which gas is burned and heat is used to produce steam and drive conventional generators. For many reactions of interest in the production of energy from chemical reactions (primarily hydrocarbon-oxygen reactions), free energy is about 10% less than the enthalpy, and the maximum intrinsic effeciency of electrochemical engines is, therefore, 90%. Unfortunately, actual cell performance is limited by overpotential, whose sources are the delay in the reduction of oxygen and the oxidation of organic fuels in the fuel cell. Overpotentials, arising at the anode and the cathode, combine to give a potential loss in the cell. Because potential is proportional to exchange current density (a catalytic rate constant) and thus related to the catalytic power of the electrode, further development of fuel cells is contingent on the growth of the science of electrocatalysis. An unconventional catalyst must be found that permits oxidation and reduction reactions to take place with the highest exchange current densities and whose heat of activation is independent of the catalytic properties of its substrate. Since current density is dependent on substrate properties, the electrode reaction in a fuel cell cannot be associated with bonding between one of the reactants and the electrode. Porous gas diffusion electrodes and tungsten bronze catalysts may obviate present difficulties encountered with fuel cells.

5689 APTIC NUMBER 15373

Bodenstein, Max and Colin G. Fink
HETEROGENEOUS CATALYTIC REACTIONS. IV. KINETICS OF CONTACT SULPHURIC ACID. (Heterogene katalytische Reaktionen. IV. Kinetik der Kontaktschefelsaeure). Text in German. Z. Physik. Chem. (Leipzig), 60(1):1-85, 1907. 40 refs.

The reaction kinetics of sulfurous acid and oxygen on platinum were studied. Oxygen and sulfurous acid were passed through a glass tube containing a platinum wire mesh. The pressure loss at constant volume was measured with a manometer. The reaction followed the equation 2SO2 + O2 yields 2SO3. The results show that the reaction rate was independent of oxygen concentration but directly proportional to the concentration of sulfurous acid and inversely proportional to the square root penetrate a layer of SO3 adsorbed on the platinum. The speed with which the slower diffusing gas, sulfurous acid, diffuses through this layer is decisive for the reaction rate. With a large surplus of sulfurous acid, oxygen diffuses slower and determines the reaction rate. The concentration ratio at which these gases exchange roles was computed from the two reaction rates. Agreement with the measurements was good. The interference of other gases, such as CO2, and NO, and the temperature coefficient were measure. Experimental results supported the theoretical expectations.

5690 APTIC NUMBER 13968

Bodenstein, M.
RATE OF THE REACTION BETWEEN NITRIC OXIDE AND OXYGEN. (Die Geschwindigkeit der Reaktion zwischen Stickoxyd und Sauerstoff). Text in German. Z. Elektrochem., 24(13-18):183-201, July 1, 1918. 26 refs.

A very detailed description is presented of an extensive series of experiments on the reaction of NO with O2 that were carried out to resolve a controversy between Lunge and Berl and Raschig. Both gases were mixed at very low pressures and the reaction was followed by observing the pressure drop, with a correction being made for the formation of N2O4. It took place strictly in accordance with the third-order equation and its rate was found to decrease quite noticeably with increasing temperature in the interval between 0 and 90 C. Furthermore, this reaction was found to be independent of additions of NO2, water vapor, and SO2. The oxidation of SO2 at the temperature used (60 C) was not catalyzed by the nitrogen oxides. The results of experiments of Lunge and Berl, evaluated in an analogous manner, were in excellent agreement with those of the author, while those of Raschig were but moderately so at conversions of more than 50%. In the light of the present knowledge of the solution process of the higher nitrogen oxides, Raschig's hypothesis regarding the role of N2O3 in the process of oxidation of NO to NO2 is no longer tenable.

5691 APTIC NUMBER 15313

Boettger, O. and H. Pingel
ISOTOPE SEPARATION WITH THE MOLECULAR PUMP. (Isotopentrennung mit der Molekularpumpe). Text in German. Vakuum-Tech., 12(2): 33-37, March 1963. 4 refs.

The separation factor and separative potential were calculated for a molecular pump with one aperture and for a complementary pump which separates a binary gas mixture into concentrated heavy and light fractions. A numerical example is given for uranium hexafluoride (UF6) having a natural composition of 0.714% U235. The same separative potential was obtained for both the complementary and single-aperture pump; the second aperture of the complementary pump thus serves primarily to draw off from the apparatus and offers only the advantage of permitting a variation of the pumping-out ratio within a certain range without major loss of separative potential. Computations were based on the assumption that a Knudsen flow prevailed in the apertures; the obtained data are thus optimum limit values which can only be adversely affected by a Poiseuille flow. The results for UF6 showed separating potentials lower by two orders of magnitude than those of the familiar diffusion and gas centrifuge methods for the same space requirement. The molecular pump is thus not well suited for the separation of uranium; but it can be used for all cases of gas separation where costs are not a major consideration and where the cleanest conditions are required.

5692 APTIC NUMBER 15482

Bol'shakov, K. A., P. I. Fedorov, and N. I. Il'ina
BINARY SYSTEMS OF SODIUM SULFATE WITH COPPER(II) SULFATE AND IRON(III) SULFATE. (Dvoynyye sistemy sul'fata natriya s sul'fatami medi (II) i zheleza (III). Text in Russian. Zh. Neorgan. Khim., 8(11):2577-2579, 1963. 7 refs.

Differential heating curves were obtained experimentally for preliminarily fused and gradually cooled melts of sodium sulfate with copper(II) sulfate and with iron(III) sulfate. The heating rate was 8-10 C per minute. The following values were found for the Cu(II) system: eutectic, 537 C; 1:1 combination, 897 C; 3:1 combination, 820 C; eutectoid 225 C. These values are all considerably higher than given by other investigators. For the Fe(III) system: eutectic (with 39% copper sulfate), 620 C; 1:1 combination, 680 C; 3:1 combination, takes place in the solid state; eutectoid, 225 C.

5693 APTIC NUMBER 15423

Bond, P. A. and W. F. Welton
SOLVATE FORMATION BY CERTAIN TETRAHALIDES IN LIQUID SULFUR DIOXIDE. J. Am. Chem. Soc., vol. 67:1691-1693, Oct. 1945. 3 refs.

The systems titanium tetrachloride-sulfur dioxide, tin tetrachloride-sulfur dioxide, and titanium tetrabromide-sulfur dioxide were investigated in the light of other studies on the solubilities of the tetrahalides of the fourth periodic group in sulfur dioxide, which resulted in the discovery of several systems where two liquid phases are in equilibrium with a single gas phase. The experimental method is described in detail and the resulting data given. The solvates formed in the systems under investigation were isolated, and their composition determined. Each was found to contain one-half molecule of sulfur dioxide per molecule of the tetrahalide. Analyses of the lower or heavy layers separated at a temperature slightly above the quadruple point gave the same composition as that of the respective solvates. These results do not, however, agree with those obtained previously by other workers. In each case the composition of the lower layer as formerly reported showed a higher percentage of the tetrahalide than indicated for the solvates here investigated. For TiCl4-SO2 the percentages were 94.5 against 85.6, for TiBr4-SO2 96 against 92, and for SnBr4-SO2 94.07 against 91.2. Further research on these systems is required to elucidate these differences.

5698 APTIC NUMBER 18538

Boreskov, G. K. and V. P. Pligunov
KINETICS OF THE CONTACT OXIDATION OF SO2. (Kinetika kontaktnogo okisleniya SO2). Text in Russian. Zh. Prikl. Khim., 6(5):785-796, 1933. 18 refs.

An isothermal method was developed for the oxidation of SO2 in a flowing system. The effects of contact time, gas composition,

and temperature on the oxidation rate of SO2 over the vanadium catalyst 'anyl were studied. The applicability of the Taylor-Lenher formula was shown. The apparent heat of activation was determined as 20,000 cal for high temperatures and 55,000 cal for low temperatures. The point of inflection was at 440 deg. The results were compared with those known for a platinum catalyst. It was shown that for temperatures higher than the point of inflection, the course of the reaction on platinum and vanadium catalysts occurs almost identically. Upon temperature decrease to the point of inflection, the rate of oxidation on a vanadium catalyst falls rapidly in proportion to the sharp increase in apparent heat of activation to 50,000 cal. In this temperature interval, the total rate of the process determines the rate of freeing the catalyst surface from the SO3 being formed. On the basis of these conclusions, the practical use of vanadium catalysts is considered. Formulas and diagrams are given, establishing the optimal curve of temperature change along the layer of contact mass. This curve provides for the maximum rate of the process, shows the time of contact necessary for carrying out any part of the oxidation, and also provides for finding the optimal composition of the gas mixture giving maximum productivity under these conditions.

5695 APTIC NUMBER 15289

Borodin, V. A., Yu. P. Mitvakin, L. A. Klyachko, and V. I. Vagodkin
ATOMIZATION OF LIQUIDS. (Raspylivaniye zhidkostey). Moscow, Izdatel'stvo 'Mashinostroyeniye', 1967. 190 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., FTD-MT-24-97-68, 310p., July 26, 1968. CFSTI: AD 685151

This book considers the problem of atomization of liquids during continuous outflow from an injector. This process takes place during the atomization of fuel in the combustion chambers of jet and rocket engines, in power furnaces, and also in a number of apparatuses used in agriculture and in chemical and food industries. Physical concepts of the mechanism of disintegration of streams, films, and drops of liquid are examined to construct a single theory of these processes. Considerable attention is paid to the theory and methods of hydraulic design of swirlers, including adjustable swirlers. The influence of parameters of injectors and physical properties of liquid on the form of streams and films, and also on the size of the liquid drops, is discussed. Data is presented on the distribution of liquid in the spray created by atomizing devices. The method of experimental investigation of injectors is reviewed. (Author abstract modified)

5696 APTIC NUMBER 15727

Bradley, J. N. and A. S. French
THE CHEMISORPTION OF CARBON MONOXIDE ON DEPOSITED METAL AEROSOLS. Proc. Roy Soc. (London), Ser. A, 313(1513):169-182, 1969. 16 refs.

A novel technique for obtaining deposited metal aerosols on multiple plates for infrared spectroscopic studies of chemisorption was described. The formation of large spherical particles under equilibrium conditions in the absence of a support offers an opportunity to obtain infrared spectra without the inherent disadvantages of other methods. The spectra observed for carbon monoxide adsorbed on nickel, platinum, and palladium are very similar to those obtained by alternative techniques. The effect of particle size throws some light on the nature of the bonding involved. The qualitative effects of evacuation and of added gases on the chemisorbed carbon monoxide were examined. Detailed studies of the oxidation of CO on platinum show that it follows a rate expression of the from k (CO (ads)) squared (02) where k (the rate constant) has an activation energy of 8.5 kcal/mol. There are two possible mechanisms which explains the observed kinetics. The first is a concerted reaction for which the mobility of adsorbed CO must be sufficiently rapid that it does not become rate-determining as the coverage of CO falls. The second mechanism is a stepwise reaction of CO(ads) + 02(gas) yields CO3(ads); CO3(ads) yields CO(ads) + 02(gas); and CO3(ads) + CO(ads) yields 2CO2(gas). This mechanism will have the required kinetics, provided that k2 is greater than k3 (CO(ads)). In this mechanism, it is not necessary to invoke the dissociative adsorption of oxygen or the simultaneous pairwise production of vacant sites. It is possible that the absence of any participation of dissociative adsorption of oxygen arises from the lower activity of the catalyst system. The observed activation energy is not inconsistent with this mechanism.

5697 APTIC NUMBER 15262

Brandt, W. Wilfried
MODEL CALCULATION OF THE TEMPERATURE DEPENDENCE OF SMALL MOLECULE DIFFUSION IN HIGH POLYMERS. J. Phys. Chem., 63(7): 1080-1088, July 1959. 13 refs.

An expression is derived for the activation energy of small molecule diffusion in high polymers in terms of the intermolecular and intramolecular interactions and of the number of degrees of freedom involved in the molecular motion. The result is used to calculate diffusion coefficients and their temperature dependence on the basis of Barrer's zone theory. The reason for the resulting Arrhenius activation energies 30 to 75% of the experimental ones is discussed. The approach indicates that the change of the activation energy at the glass transition found experimentally in many polymers can be understood as a consequence of the change of the thermal expansion coefficient at this point. Certain details of molecular structure, such as the shape of the potential barrier of hindered rotation and the number of degrees of freedom per monomer unit, are found to have only a small effect on the resultant diffusion properties. The calculated effect of the penetrant molecule's size on the activation energy is in good agreement with experimental data. (Author abstract modified)

5698 APTIC NUMBER 15037

Bras, G. H.
DESIGN OF COOLER CONDENSORS FOR VAPOR-GAS MIXTURES. II. Chem. Eng., 60(5):238-240, May 1953.

A method for designing cooler condensors which operates successfully whether or not the vapor-gas mixture remains saturated during condensation is applied for the design problem of calculating the required surface area for condensors for an ammonia oxidation plant. The principles developed can also be applied to the design of other equipment in which simultaneous heat and mass transfer take place. Such equipment includes humidification, drying, evaporation, and cooling towers.

5699 APTIC NUMBER 15061

Bras, G. H.
DESIGN OF COOLER CONDENSERS FOR VAPOR-GAS MIXTURES - I.
Chem. Eng., 60(4):223-226, April 1953. 8 refs.

A graphical method for the design of cooler condensers is presented for handling mixtures of noncondensible gases and saturated or non-saturated vapors. When a mixture of vapors is introduced into a cooler condenser, condensation of the vapors starts as soon as the temperature of the cooling tube wall falls below the dewpoint of the gas mixture. To calculate the cooler condenser, heat and mass transfer coefficients must be known, and can be computed from the information in the literature. The driving forces for both the heat and mass transfer can be calculated as soon as the temperature and vapor pressure in the main bulk of the gas, and the cooler wall temperature are known. This method permits following the condition of the gas-vapor mixture with respect to temperature and vapor pressure as it passes through the cooler. A relationship derived for dilute gas-vapor mixtures is the basis of the method which is applied graphically to a temperature-pressure diagram to show the point-to-point temperature-vapor pressure relation of the mixture as it passes from entrance to exit of the condenser. The temperature and vapor pressure of the condensate on the tube is found by trial and error, as well as the value of the unit heat transfer. The cooling surface area for the condenser is obtained by graphical integration of an equation.

5700 APTIC NUMBER 18582

Braunstein, J. and R. P. Wagman
THE ASSOCIATION OF SILVER ION AND IODIDE ION IN MOLTEN SODIUM NITRATE AND IN MOLTEN MIXTURES OF SODIUM NITRATE AND POTASSIUM NITRATE. J. Phys. Chem., vol. 67:2881-2882, Dec. 1963. 11 refs.

The results of measurements of the association of Ag(I) with I(-) in molten mixtures of NaNO3 and KNO3 were compared with previously reported results and are shown to be consistent with the 'reciprocal coulomb effect'. The stability of the ion pair Ag(I)I(-) increases slightly more in KNO3 than in NaNO3 as the ratio of Na(I) to K(I) in the solvent increases. This increased stability with increasing proportions of Na(I) in the solvent is in the direction predicted by the 'reciprocal coulomb effect' assuming that the 'effective spherical radius' or distance of closest approach of iodide ion is slightly larger than that of the nitrate ion, and appears to confirm the importance of the reciprocal coulomb effect. Since the nitrate ion is not spherical, the assignment of radii to I(-) and NO3(-) (which are nearly the same size) and a quantitative calculation are difficult.

5701 APTIC NUMBER 15303

Brcic, B. S., L. Golic, P. Peternel, J. Siftar, and M. Zuser
STUDY OF THE SYSTEM CAO-AL2O3 AT LOW TEMPERATURES. (Beitrag zur Kenntnis des Systems CaO-Al2O3 bei niedrigen Temperaturen). Text in German. Vestn. Sloven. Kem. Drustva, 9(1-2):22-32, 1962. 10 refs.

The reactivity of the systems Ca(OH)2-Ca(NO3)2 and CaO-Ca(NO3)2 with alpha-Al2O3, Baverite, and Boehmite was studied. In all syntheses, the reaction product 5CaO.3Al2O3 was obtained regardless of the initial aluminum components, the ratio of the initial components, the temperature, or the duration of the reaction. In the system wi Ca(OH)2, a marked maximum of the reactivity was found at 475 C, which is 100 C lower than in the previously studied reactions with SiO2 and TiO2. The characteristic reaction process in the system with CaO was found to agree with the findings of the earlier studies. Thus, the maximum observed at 475 C in the system with Ca(OH)2 is explained by a thermal dissociation of the hydroxide. In the system Al2O3 (Baverite or Boehmite) + 2.4Ca(OH)2 + 0.6Ca(NO3)2, the reaction was almost complete within 2 hrs at temperatures from 475 to 575. The highest output of bound Al2O3 was 73%, and even with a starting proportion of 0.7Ca(OH)2 + 0.3Ca(NO3)2, only a 90% output could be achieved.

5702 APTIC NUMBER 14860

Bredig, M. A.
ELECTRICAL CONDUCTANCE AND DENSITY OF ALKALI METAL NITRATE MELTS. J. Phys. Chem., 69(5):1753-1758, May 1965. 1 ref.

Measurements of conductivity and density of nitrate melts reported by Papaioannou and Harrington showed that the effects of very small additions of halides were so large that, if real, they would seem to require a major revision in the thinking about molten salts, if not liquids in general. Absence of numerical values for partial molar volumes and large errors in calculation that appear to have occurred in their table summarizing conductivity results may have obscured the disturbingly vast magnitude of the effects. Instead of accepting what would be an unexpected development in the field of fused salt chemistry, this author has found it preferable to assume that the effects were not real, but were artifacts. Some may have been produced by gas bubbles from the catalytic decomposition of nitrate, especially LiNO3. Others, such as the large increases in conductivity in LiNO3 melts probably had their origin in partial short-circuiting through the wall of the capillary cell as a result of penetration by the decomposition product, lithium oxide, with its highly mobile Li(I) ions.

5703 APTIC NUMBER 18567

Bretsznaider, S., W. Kawecki, and W. Fotowska
MASS TRANSFER COEFFICIENTS IN THE PROCESS OF ABSORPTION OF SULPHUR DIOXIDE IN SODA SOLUTIONS. Bull. Acad. Polon. Sci., Ser. Sci. Chim. Geol. Geograph., 7(9):691-698, 1959. 1 ref.

A study was made of the optimum conditions for carrying out chemisorption using an aqueous soda solution as absorbent and 1.2% SO2 in humidified air as absorbate. The values of mass transfer coefficients were determined as a function of the type of apparatus used and of the reaction conditions. Columns used were an unpacked wetted-wall column, a column packed with Raschig rings, and a foam absorption column with a perforated bottom. The other elements of the apparatus for the heating and humidifying of the gases were the same in all the series of experiments. The temperature, composition, and mass velocity of the liquid and the gas were also the same. The results showed the superiority of the foam absorption method in comparison with absorption in a packed column and in a wetted-wall column. The continuously refreshed interfacial surface causes a nearly tenfold increase in the process rate.

5704 APTIC NUMBER 15013

Breger, Max P. and Karl Kammermeyer
EFFECT OF CONCENTRATION GRADIENTS IN BARRIER SEPARATION CELLS. Separ. Sci., 2(3):319-338, 1967. 8 refs.

Concentration gradients in the gas phase above and below the barrier in separation cells were measured using both microporous and polymeric barriers. The experimental data were compared with existing theories and none of the theories aequately correlated the data over the range of parameters studied. A two-part theoretical model was developed. In the first part, plug flow, or unidirectional flow, is assumed. This is essentially a no-mixing theory which allows for both high- and low-pressure flow streams to be adjacent to the barrier. In the second part, diffusional flow caused by the concentration gradient is taken into account. A straightforward numerical solution to the plug flow model was developed. An approximate solution for the model, involving diffusional flow, was proposed. The plug flow equations are solved and then a correction factor involving diffusion is added to the plug flow solution. This iterative approximate solution converges in most cases. The proposed model represents the experimental data in this study more adequately than any of the previous models. Given the feed concentration, feed flow rate, barrier and cell geometry, and permeability and diffusion coefficients, this model predicts the concentration gradient on both the high- and low-pressure sides of the cell. It also yields predictions of both permeated and nonpermeated outlet concentrations, and the permeated flow rate. Where the iterative solution to the diffusion mixing model does not converge, the model does not adequately predict the concentration profile, but it still gives adequate predictions for outlet conditions. Although developed in a study of separation of gases, this theoretical model could be applied to other systems as well, if the proper permeability and diffusion coefficients were used. (Author conclusions modified)

5705 APTIC NUMBER 14901

Brewer, Leo
THE THERMODYNAMIC PROPERTIES OF THE OXIDES AND THEIR VAPORIZATION PROCESSES. Chem. Rev., 52(1):1-75, 1953. 471 refs.

The information necessary to carry out thermodynamic calculations in systems involving oxygen compounds is provided and reviewed. For each binary system, the solid phases that can exist and the gaseous oxide species that are expected to be of chemical importance are discussed. The problem of nomenclature was difficult for naming solids. Consideration is given to the known oxide phases, their crystal structures, and their temperature and composition ranges. Heat of formation data is also given for each phase, together with consideration of high-temperature equilibria data that relate to the thermodynamic data. Vaporization data is analyzed in terms of the possible gaseous molecules that could be involved, and the stability of the various gaseous molecules is considered. The constant-boiling compositions of each system, and the composition of the vapor in equilibrium with each phase, is discussed. (Author introduction modified)

5706 APTIC NUMBER 18882

Bridgeman, Oscar C. and Elizabeth W. Aldrich
TABULATIONS OF GAS SOLUBILITIES IN HYDROCARBON AND OTHER NON-AQUEOUS SOLVENTS. Phillips Petroleum Co., Bartlesville, Oklahoma, Jan. 18, 1955, 31p., 48 refs.
ASTIA, AD:88791

Tables of the available information of the solubility of a number of gases in hydrocarbons and other non-aqueous solvents are compiled. There are a considerable number of methods for expressing gas solubilities. Frequently, the literature data are incorrectly designated or computed, and an attempt was made to rectify those errors. All gas solubility values summarized are expressed as Ostwald solubility coefficients, namely the volume of the gas at the stated temperature and prevailing partial pressure dissolved in one volume of liquid at the stated temperature. This method was selected for uniformity and also because the value is essentially independent of the gas pressure. For high pressures, a correction is required to account for the departure from the perfect gas laws. In the conversion of the literature values to Ostwald solubility coefficients, for which precise relations exist, the final result was expressed to the same number of figures as the original recorded value. Since the data on air solubility is a mixture of gases, the solubility, value will depend upon the V/L ratio prevailing at the time of measurement because the different components have different solubility coefficients. This is a matter for detailed computation in each individual case. Such computations were made for all literature data on air solubility and the Ostwald coefficients for air in the tabulation refer specifically to a dissolved gas of normal air composition, unless otherwise noted. Theoretical relations between the solubilities

of a given gas in a variety of liquids constitute a guide to weighting the accuracy of values by different observers and can be employed to extend the range of knowledge of the solubility of a given gas in a given liquid.

5707 APTIC NUMBER 14643

Briner, E. and P. Monnier
REACTIONS OF SULFUROUS ANHYDRIDE ON CALCIUM CARBONATE AND PHOSPHATE. (Les reactions de l'anhydride sulfureux sur le carbonate et le phosphate de calcium). Text in French. Helv. Chim. Acta, vol. 13:80-85, 1930. 8 refs.

At ordinary temperatures, liquid or gaseous sulfur dioxide does not react appreciably, even after a month, with calcium carbonate. On heating to 95 deg, the action between gaseous sulfur dioxide and calcium carbonate proceeds relatively easily according to the equation 2CaCO3 plus 3SO2 yields 2CaSO4 plus S plus 2CO2. This exothermic reaction (74 cal) differs from that of sulfur dioxide with calcium carbonate in the presence of water; the latter gives sulfite according to the general mechanism whereby stronger acids displace weaker acids. Dry sulfur dioxide does not react appreciably with tricalcium phosphate at ordinary temperatures; on heating, the reaction produces calcium sulfate, calcium pyrophosphate, and sulfur.

5708 APTIC NUMBER 14620

Briner, E., G. H. Lunge, and A. van der Wijk
RESEARCH ON THE REACTIONS BETWEEN NITROGEN PEROXIDE AND SULFUR DIOXIDE. (Recherches sur les reactions entre le peroxyde d'azote et l'anhydride sulfureux). Text in French. Helv. Chim. Acta, vol. 11:1125-1148, 1928. 15 refs.

Laboratory techniques for studying the reactions of nitrogen dioxide and sulfur dioxide, both in the liquid and gas phase, are elaborated. In the liquid phase, under 100 atm pressure, the following overall reaction occurs: 3/2 N2O4 plus 2SO2 yields S2N2O9 plus NO. The compound S2N2O9 behaves like an anhydride of nitrosyl sulfuric acid in its reactions with water, alkali, and SO2. It is stable at ordinary temperatures even in a vacuum. Heat decomposes it into the compounds S2NO7 and NO2; the reaction is slightly reversible. The reaction forming S2N2O9 from liquid sulfur dioxide and liquid dinitrogen tetroxide is very exothermic; its heat of reaction has been evaluated at 112 cal/g-mole. In the gas phase, the reaction between dinitrogen tetroxide and SO2 proceeds somewhat slowly at ordinary temperatures and pressures and more rapidly at elevated temperatures. Reaction products at 80 deg and above have an average nitrogen content less than that of the compound S2N2O9. Curves representing the course of this reaction reached a plateau long before it had been formed. The reaction does not take place if the gases are placed in contact at sufficiently low pressure. In the presence of catalysts, the reaction is very rapid but does not go to completion even at low pressures.

5709 APTIC NUMBER 13776

Brinkman, W.
THE USE OF NATURAL GAS IN SPARK IGNITION ENGINES. Diesel Engineers and Users Assoc., London, Publication 320, 13p., June 1968. 6 refs. (Presented at the General Meeting, Diesel Engineers and Users Assoc., London, Feb. 15, 1968.)

A gas suitable for use as a fuel in a mixture compressing engine can be judged by (1) its knock characteristics under operating conditions, (2) the surface temperature under operating conditions, and (3) the calorific value of the mixture. Tests using methane and hydrogen as reference fuels show a good linear relationship between gas mixture ratio and compression ratio at which a detonation knock starts. Comparative tests of the knock behavior of natural gases and other fuels in four-cycle test engines demonstrated that methane, ethane, and propane are, in this order, the best hydrocarbons for use in gas engines. Of these gases, methane has the highest pre-ignition rating. Test results obtained with Thomassen six-cycle gas engines using natural gas or commercial propane as fuel indicate that a natural gas comprising 81.7 vol% methane and 14 vol nitrogen is an ideal fuel for turbo-charged gas engines because of its high detonation limit and its high pre-ignition rating. Turbo-charging is shown to produce better cooling of the combustion engine. If a part of the exhaust gases can be recovered, the thermal efficiency of a gas engine, running on natural gas, should be comparable to that of a diesel engine. Exhaust gases are clean and, having a temperature of 500 C, can be considered as an ideal basis for applying a 'total energy' system.

5710 APTIC NUMBER 14896

THE COMBUSTION OF SMALL SIZES OF COKE IN A DOMESTIC BOILER. British Coke Research Assoc., Chesterfield, (Derbyshire), Coke Research Rept. 48, 10p., March 1968.

The influence of a reduction in lump size on the combustion of coke singles in a small domestic boiler was studied. The combustion performances of two cokes were examined. In the case of the first coke, narrow grades of small lump sizes ranging from five-eighths to one-eighth of an inch were used. The ignition and high-output stages of combustion were examined. The size of the second coke was modified from that of commercially produced singles to allow 95% (the lower limit) to be progressively reduced from five-eighths to three-eighths to one-fourth of an inch while 5% (the upper limit) was maintained constant. Three further samples were prepared, involving the introduction of varying proportions of breeze into the singles. Each size of the coke was tested dry and with a total moisture content of 10%. During the combustion tests, the fuel loss through the boiler firebars was estimated. Satisfactory combustion using narrow grades of coke was not achieved. The detrimental features included the lack of thermostatic control and severe fuel losses. A drop in the lower size limit of coke singles of 95% greater than three-eighths of an inch, resulted in a prolongation of the time to attain the rated output, even when the coke contained 10% moisture. Further size reduction reduced the maximum output below the normal

level required. The addition of up to 25% of breeze to coke singles has no adverse effect on combustion performance, although there was an increase in the time to attain rated output. When the lower size limit of the coke was dropped to one-fourth of an inch by the addition of breeze, there was a relatively small increase in the quantity of material lost on charging. Observations from the limited data obtained when the fuel bed was de-ashed suggested that there was a slightly greater loss of material from the samples containing a greater proportion of smaller coke.

5711 APTIC NUMBER 14529

Brynestad, J., E. Griotheim, and C. Krohn
THERMODYNAMIC TREATMENT OF EQUILIBRIA IN FUSED MIXTURES OF RECIPROCAL SALT SYSTEMS. Rev. Roumaine Chim. (Bucharest), vol. 9:163-175, 1964. 9 refs.

A method for the calculation of the thermodynamic activity in molten symmetrical reciprocal salt mixtures from the exchange equilibrium constants is discussed and demonstrated on the system NaCl - KCl - NaBr - KBr, and an approach is shown for deriving expressions for the activity of a single salt component in any molten mixture. Several points are emphasized about the method. In the cation exchange equilibria, a gas mixture as a second phase is not a requisite; a metal alloy could be used as well. If gas mixtures are utilized, ideal behavior might be assumed. For the alloys, however, the activities of the dissolved species in the metallic phase ought to be known. Experimental determinations will be more problematic if dissolution of the gases and particularly of the molten metals in the molten salts occurs. Since cation exchange equilibria are experimentally difficult to study, phase diagrams and calorimetric measurements are discussed as alternative means of obtaining information on these exchange reactions. The determination of activity coefficients in asymmetrical reciprocal salt mixtures is demonstrated as identical to that of the symmetrical reciprocal salt mixtures. The general formulae presented have been applied by other investigators, in somewhat simplified form, to calculate the activities in some slag systems. Excellent agreement between measured and calculated activity coefficients have been established.

5712 APTIC NUMBER 15066

Buddenhagen, D. A., A. V. Haeff, G. P. Smith, G. Oster, and G. K. Oster
OBSERVATIONS OF RUBY-LASER BEAM-INTENSITY PATTERNS WITH DYE-SENSITIZED PHOTOPOLYMERS. Proc. Natl. Acad. Sci. U.S., 48(2):303-305, Feb. 1962. 5 refs.

Spatial distribution of the light intensity in the beam emerging from the ruby laser was observed by use of a dye-sensitized photopolymerization technique. Three-dimensional button-shaped solid plastic photographs provided intensity information versus position on the end of the ruby, since the depth of exposure is monotonically related to beam intensity. Experiments were performed with two monomer-activator systems, one comprising a 40% solution of acrylamide containing a saturation quantity of methylene bis(acrylamide) as cross-linking agent, about 0.001% methylene blue, and N,N,N',N'-tetramethylethylenediamine as electron donor. The second system was composed of 40% aqueous calcium acrylate with methylene blue and tetramethylethylenediamine. The sensitivity of these monomer-activator systems to radiation in the absorption region of the photo-reducible dye is strongly dependent on the concentration of residual oxygen in the aqueous solution and on the concentration of the electron donor for a given dye concentration. A large proportion of cross-linking agent is necessary for the formation of a firm gel structure. A polymer such as calcium polyacrylate, which is produced from the calcium acrylate monomer-activator system, forms an aggregated colloidal gel which scatters visible light. This makes the polymer easily discernible in the solution as soon as it is formed, but probably impairs the photographic resolution, especially at some depth into the solution.

5713 APTIC NUMBER 14756

Rudelot, Jean-Pierre and Denise Delafosse
ADSORPTION OF SULFUR DIOXIDE AT THE SURFACE OF NICKEL DISULFIDE. (Adsorption du gaz sulfureux a la surface du disulfure de nickel). Text in French. Compt. Rend. Acad. Sci. (Paris), vol. 259:385-388, July 15, 1964. 6 refs.

In order to determine the effect of sulfur dioxide on the oxidation of hydrogen sulfide using nickel disulfide as a catalyst, the mechanism of adsorption of sulfur dioxide on the surface of nickel disulfide was studied. The volume adsorbed on a known quantity of sulfide and the variation in electrical conductivity during adsorption were determined. The adsorption of sulfur dioxide is physical between the temperatures 20 and 120 C. A heat of adsorption of 8 plus or minus 0.5 kcal was calculated. Between 120-180 C, the process is both chemical and physical. Below 120 C, there was no variation in conductivity; above 120 C, the conductivity increased with temperature. This led to the conclusion that the mechanism of adsorption is as follows: SO2 yields SO2(ads) yields SO2(I) + e(-).

5714 APTIC NUMBER 14861

Buechler, Alfred and James L. Stauffer
GASEOUS ALKALI-NITROGEN-OXIGEN AND ALKALI-PHOSPHORUS-OXIGEN COMPOUNDS. J. Phys. Chem., 70(12):4092-4098, Dec. 1966. 9 refs.

Mass spectra of lithium and sodium nitrate and nitrite vapors were examined to determine whether polymers were present. The mass spectrum of the vapor in equilibrium with lithium phosphate was also examined. The mass spectra of vapor above lithium and sodium nitrate and nitrite showed large amounts of permanent gases being given off. For the nitrates, the principal gaseous decomposition product was O2, whereas in the case of the nitrites, roughly equal amounts of NO and N2 were given off. In addition, each of the mass spectra contained

ions of the type M(+), MY(+), and M2Y(+) where M equals Li or Na and Y equals NO3 or NO2. Such mass spectra are typical of the alkali halides and pseudohalides, and immediately indicate the presence of the dimers Li2(NO3)2, Na2(NO3)2, Li2(NO2)2, and Na2(NO2)2. For the two nitrates and sodium nitrite, the ratio MY(+)/MY2(+) varied with temperature, thus indicating that the monomers LiNO3, NaNO3, and NaNO2 were also present. In the case of the two nitrates, monomer and dimer appear to be present in approximately equal amounts. In the case of sodium nitrite, the dimer is the principal species. The existence of gaseous nitrates and nitrites suggested the possible existence of the corresponding metaphosphates and metaphosphites. The mass spectrum of the vapor above liquid Li3PO4 was examined. In addition to decomposition products such as P2(g) and Le2O(g), a significant amount of lithium metaphosphite was found, together with a much smaller amount of lithium metaphosphate. The gaseous nitrate and nitrite species reported are typical of the vapor species associated with the vaporization behavior of halides and pseudohalides. The dimerization energy of LiNO2 derived also was typical of such compounds. It was concluded that further work would be necessary to classify the nature of bonding in the alkali nitrates and nitrites.

5715 APTIC NUMBER 15075

Bugrim, K. D., A. I. Lyutyi, and V. S. Rossikhin
ON THE VIBRATIONAL RELAXATION OF DIATOMIC MOLECULES IN AN EXCITED ELECTRON STATE. Opt. Spectry. (USSR) (English translation from Russian of: Opt. i Spektroskopiya), 21(1):13-15, July 1966. 11 refs.

Peculiarities associated with the vibrational relaxation of diatomic molecules in the excited electron state are examined. The diatomic molecules are considered as harmonic oscillators, and if they constitute a small impurity in the principal gas, vibrational relaxation takes place isothermally. Differential equations describing the process are solved by the method of the generating function. If electron-vibrational bands due to transitions from the relaxing electron level are recorded experimentally, study of these bands yields information on the quantities characterizing the efficiency of energy exchange between particles in the reacting medium. The behavior in time of the populations of the vibrational levels of the relaxing electron state can be determined by recording the intensities of the corresponding electron-vibrational bands at various times after the instantaneous formation of the molecules.

5716 APTIC NUMBER 15507

Bullrich, K., P. Fiden, G. Fschelbach, K. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
EVALUATION OF THE AEROSOL PARTICLE SIZE DISTRIBUTION FROM MEASUREMENTS OF THE VOLUME SCATTERING FUNCTION. In: Research on Atmospheric Optical Radiation Transmission. (Final Rept.) Johannes-Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie, Contract F-61052-67-C-0046, APCRL-69-0266, p. 102-111, Jan. 1969. 38 refs.

Because of deficiencies associated with collection plate methods of determining size distribution of aerosol particles, an attempt was made to evaluate aerosol size frequency distribution from measurements of the scattering funcion of a free atmospheric air volume. Scattered light emitted by a collimated beam was collected in a rotating device, making it possible to determine the angular dependence of the intensity of scattered light and, finally, the scattering function of the aerosol volume. To indicate the function in terms of absolute units, the measured luminance of the scattered light was related to the luminance of the original collimated beam. Equations were derived for computing the collective scattering function for individual radius intervals and for representing continuous size distribution.

5717 APTIC NUMBER 15000

Bullrich, K., P. Fiden, G. Fschelbach, K. Fischer, G. Haenel, K. Heger, H. Schollmayer, and G. Steinhorst
RESEARCH ON ATMOSPHERIC OPTICAL RADIATION TRANSMISSION. THE TRIPLE SCATTERING AND THE INFLUENCE OF THE ANGULAR DEPENDENCE REFLECTED RADIATION IN THE TURBID ATMOSPHERE. Johannes-Gutenberg-Universitaet, Mainz, Germany, Inst. fuer Meteorologie Contract F 61052-67-C-0046, APCRL-69-0266, Final Report, p. 82-111: Jan. 1969. 38 refs.

The radiation on the earth's surface after triple scattering on gaseous and aerosol particles is computed for a homogeneous and plane parallel atmosphere. The calculations are discussed in detail. Theoretical treatment is applied to the reflectivity and albedo of the surface of the earth, reflection of direct solar radiation and sky light, and the attenuation of the reflected radiation by the atmosphere. The smooth curves and the computed intensity values plotted show distinct departures for triple scattering. This implies numerical instability at the integration processes which mainly result from the scattering function.

5718 APTIC NUMBER 14909

Bunkin, F. V., R. V. Karapetyan, and A. M. Prokhorov
DISSOCIATION OF MOLECULES IN A STRONG RADIATION FIELD. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz., 20(1):185-188, Jan. 1965. 6 refs.

The probability of dissociation of molecules in the radiation field of a ruby laser, when the magnitude of the quantum of radiation is less than the dissociation energy, is considered. It is hypothesized that dissociation of polar diatomic molecules occurs by strong buildup of their oscillations, that is, by means of excitation of high vibrational states of the molecules with transition to the continuous spectrum. Analysis is carried out by perturbation theory, and the probabilities for two- and three-photon dissociation are calculated. Numerical estimates show that the dissociation process due to the proposed mechanism should be observable. (Author abstract modified)

5719 APTIC NUMBER 15068

Burnett, R. W. and W. T. Turnbull
INDUSTRIAL APPLICATIONS OF MOLECULAR SIEVES. Brit. Chem. Eng., 11(8):261-262, April 1966.

The high efficiency of molecular sieves as adsorbents and the simplicity of their regeneration has resulted in their widespread use. Aspects of their advantages are discussed. Molecular sieves are used in multiple-bed and single-bed adsorption systems. The multiple-bed adsorption method is used for large-scale commercial fluid purification operations. When interrupted product flow can be tolerated, it is convenient to use a single adsorption bed. The versality of molecular sieves in commercial adsorption units is reflected by the wide variety of mixed liquid and gas streams being treated to remove water, carbon dioxide, hydrogen sulfide, and other impurities. Process streams being dried and purified include alkylation, isomerization, catalytic reforming and hydrocracking feedstocks, liquified petroleum gas (LPG), natural gas and its condensate, cracked gas, kerosene, jet fuel, adsorber oil, transformer oil, and hydrocarbon solvent mixtures. Whether in mixed streams such as these or simpler product streams, molecular sieves are being used to purify all types of chemicals. An application is the one-step treatment of LPG to produce a dry sweetened product by the simultaneous removal of H2S, mercaptans, and water which eliminates the need for caustic scrubbing. Co-adsorption problems are solved by selecting a molecular sieve with a critical pore diameter small enough to prevent all stream components except water from being admitted to the active inner surfaces of the adsorption cavities. Molecular sieves are outstanding in their ability to produce low effluent water concentration and are ideal adsorbents wherever extremely dry gas streams are required. Molecular sieves exhibit optimum performance in drying gas at low inlet humidity. This feature is being put to use in argon and nitrogen purification systems where gases are dried from an inlet condition of less than 1% relative humidity to an effluent water content consistently below 1 ppm.

5720 APTIC NUMBER 15072

Caldirola, P. and G. Rossi
ISOTOPIC EFFECTS IN ADSORPTION AND SURFACE MIGRATION. In: Proc. Symp. Isotope Separation, Amsterdam, 1957, J. Kistemaker, J. Bigeleisen, and A. O. C. Nier (eds.), New York, Interscience, 1958, Chapt. 45, p. 581-588.

The roles of adsorption and surface migration in the separation of isotopes by gas diffusion were evaluated by deriving equations to calculate the probability of transitions which determine the process of adsorption, the process of migration on capillary tubes, and isotopic enrichment. The formula for calculating the transitions assumes that a gas atom is subject only to a perpendicular force at the surface of a solid, while that for calculating the flow of migration assumes in addition the existence of tangential forces on the surface of the solid. The formulae were applied to a numerical calculation of a gas formed from the mixture of two isotopic species, He3He4, interacting with a LiF crystal lattice. Results are plotted as isotopic enrichments for the Knudsen flow, for surface migration flow, and for total flow vs temperature. The curves reveal that when a flow of surface migration is superposed on the Knudsen flow, the resulting isotopic enrichment decreases: the lower the temperature the more marked is this decrease, either because surface migration decreases with temperature or because the ratio between flow of surface migration and flow of Knudsen increases as temperature decreases.

5721 APTIC NUMBER 15522

Carnicom, Nina I.
REACTION RATES FOR HIGH - TEMPERATURE AIR WITH CARBON AND SODIUM IMPURITIES. Sandia Corp., Albuquerque, N. Mex., SCR-R-68-1799, 148p., May 1968. 226 refs.
CFSTI: PT 182622

The values used by a number of investigators for the rate constants of high-temperature (greater than or equal to 1000 K) homogeneous gaseous reactions involving species of nitrogen, oxygen, carbon, and sodium were compiled and presented in tabular form. Included are reactions involving neutral species, charged species, free electrons, some species in excited electronic or vibrational states, and radiative processes. No attempt was made to pass judgement on the validity of the individual rate constants, or on the possibility of the reported reactions at the temperature range considered.

5722 APTIC NUMBER 15167

Carter, J. W.
ADSORPTION PROCESSES. Chem. Process Eng., 47(9):70-77, Sept. 1966. 12 refs.

Adsorptive capacity and, to a lesser extent, the effective diameter of the internal pores of an adsorbent are important variables influencing the choice of adsorbents for particular separation problems. For drying gases or liquids at low temperatures, molecular sieves are advantageous in their higher capacity. This is particularly the case when drying organic liquids or vapor mixtures of hydrocarbons and other organics. Molecular sieves are also suitable for adsorbing organic compounds such as hydrogen sulfide, carbon oxysulfide, and olefins at relative low humidities. At high relative humidities, the ultimate capacity of silica gel and activated aluminum are higher. Empirical or semiempirical methods must be used to estimate the quantity of absorbent necessary and the dimensions of a suitable absorber bed. Flow and pressure drop requirements of the bed and of the regenerating circuit must also be computed. Predicting the performance of fixed-bed adsorbers is difficult because adsorption processes involve a number of interacting mechanisms. Mathematical treatments can give no more than a guide to the best practice. Numerical methods of solution involving high-speed digital computation are required to explain the influence of these mechanisms.

5723 APTIC NUMBER 14815

Castellano, E. and H. J. Schumacher
KINETICS OF THE PHOTOCHEMICAL DECOMPOSITION OF OZONE IN 3130 A ULTRAVIOLET LIGHT. Institut Superior de Investigaciones, Buenos Aires, Argentina, Facultad de Quimica y Farmacia, Grant AF-AFOSR-979-65A, AFRPL-TR-69-42, 34p., Feb. 1969. 22 refs.
AD 683733

To better define its stability, the following selected routes of ozone decomposition were investigated: the photochemical decomposition of ozone by the use of an Hg-line 3130 A light source; the behavior of O ('D) atoms as species possibly capable of initiating ozone decomposition; and the kinetics of the O ('D) + O3 yields 2 O2 reaction in the presence of oxygen and inert gases. Results demonstrate that the maximum quantum efficiency is 6 for pure ozone and is not influenced by pressure, temperature, or light intensity. Addition of foreign gases decreases the quantum efficiency to a limiting value of 4 in an oxygen-free system. Water vapor increases the reaction rate very markedly. A mechanism for the photodecomposition of O3 is presented and shown to be consistent with the data selected. (Author abstract modified)

5724 APTIC NUMBER 14968

Caulet, T., J. J. Adnet, and C. Hopfner
A HISTOCHEMICAL STUDY OF A VARIETY OF PULMONARY ALVEOLAR CELLS: CELLS CONTAINING COMPLEX LIPID INCLUSIONS. (Etude histochimique d'un type de cellules alveolaires du poumon: Les cellules a inclusions lipidiques complexes). Text in French. Histochemie, vol. 15:21-37, 1968. 75 refs.

Cells containing phospholipid inclusions represent a considerable contingent of the alveolar cells of the lung: their high saturated phospholipids content is a special feature of the metabolism of the normal lung. The characteristics of this type of cell were studied from the lung tissue of rats by bichromate fixation and various biochemical techniques. The cells are characterized morphologically by their appearance: in addition, they can be distinguished by their abundance of oxidative enzymes, dehydrogenases and oxidases. They also contain alkaline phosphatases and nonspecific esterases. The abundance of enzymes seems to indicate that they play a very active part in metabolism. The problem of the way such cells change during pathological processes remains difficult to define. The cells themselves and the substances they secrete are connected with the formation of the endo-alveolar lining. Further investigations, particularly autoradiographic and histo-enzymatic ultrastructural studies, are required to confirm and complete these findings. (Author abstract modified)

5725 APTIC NUMBER 15668

Chaika, P. A.
EXPERIMENTAL UNIT FOR POISONING ANIMALS WITH VISCOUS LIQUID AEROSOLS. (Eksperimental'naya ustanovka dlya zatravki zhivotnykh aerozolem vyazkikh zhidkostey). Text in Russian. Gigiyena Truda i Prof. Zabolevaniya, no. 8:58-61, 1969. 3 refs.

The device described consists of a vacuum chamber measuring 100 by 70 by 40 cm. A vacuum of 10-15 mm H2O is produced with a Vikhr' vacuum cleaner attached to the base of the chamber. An incoming air stream passes through a mechanical rotary disintegrat r, carrying liquid particles into the path of a second air stream entering at the top of the chamber. Aerosol density and particle size are regulated by varying the depth to which the rotating disks of the disintegrator are submerged, and also by varying the rate of rotation. This arrangement is used to inoculate animals with anthracene oil, producing an aerosol concentration of 0.01 to 1.0 mg per liter.

5726 APTIC NUMBER 15811

Chapman, S.
ON THE KINETIC THEORY OF A GAS. PART II. A COMPOSITE MONATOMIC GAS: DIFFUSION, VISCOSITY, AND THERMAL CONDUCTION. Trans. Roy. Soc. Philosophy, 217A(553):115-197, June 25, 1917. 57 refs.

This paper considers the three mean free-path phenomena of a composite gas: diffusion, viscosity, and thermal conduction. Viscosity and conduction are treated more briefly than diffusion, but a method is developed that enables their approximation to be carried to high degrees of accuracy. The true law of the distribution of velocities is determined, and an exact expression is obtained for the coefficient of diffusion of molecules which is applicable to the most general case of a composite monatomic gas. A formula similar to Langevin's is derived for estimating the diffusion coefficient of elastic spherical molecules; it is multiplied by a correction factor which is a function of the relative proportions of the component gases. In an investigation of other diffusion phenomena, it is shown that diffusion may be produced by a gradient of pressure or temperature independently of the presence of a concentration gradient or of external forces. The amount of this effect is considered. Conversely, the absence of diffusion in a composite gas in which the temperature is nonuniform implies the existence of a corresponding variation in the relative concentration of the two gases. The latter amount is so large that some compensating influence appears to have been overlooked in the theory. Methods are presented for determining velocity-distribution functions, including velocity-distribution in electronic diffusion.

5727 APTIC NUMBER 15102

Chardin, J., P. Plurien, and S. Rommedac
APPLICATION OF GENERAL METHODS OF STUDY OF POROUS BODIES TO THE DETERMINATION OF THE CHARACTERISTICS OF BARRIERS. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:380-387. 13 refs. (Translated from French).

Barrier conditions for the separation of the uranium isotopes by gaseous diffusion required an adaptation of the usual methods

for studying porous bodies to the examination of the characteristics of prototype barriers. Only by a combination of the different methods is it possible to check on progress made in fabricating various prototypes. Experimental methods described include various adsorption methods, electron microscopy, X-rays, porosity measurements with mercury, liquid permeability measurements, gas permeability measurements, and measurement of separation efficiency. Comparison of the various results obtained by these methods makes it possible to accurately define the fundamental characteristics, the permeability, and effective pore radii of various prototype barriers. The most rapid and direct method is measurement of the permeability by air. This method is only valid if the results are periodically checked against results found by the Brunauer, Emmett, and Teller method, X-rays, and permeability to liquids for effective radii smaller than 300 A, and by the mercury method, separation of a gas mixture, and permeability to liquids for radii larger than 200 A.

5728 APTIC NUMBER 18886

Chayanova, E. A. and E. S. Shifrin
THE SCATTERING INDICATRIX OF THE ATMOSPHERIC BOUNDARY LAYER. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfer. i Okeana), 4(2):233-245, Feb. 1968. 4 refs.

The diagrams developed by Koitzik and Tschaeck are often used as aerosol indicatrix of the atmospheric boundary layer, but they exist only in the range of angles 16 to 168 deg or less than 10 deg. Values in the small-angle range must be determined by extrapolation. The formula used to check the validity of this extrapolation is based on the condition that the attenuation factor obtained in integrating the scattering indicatrix with respect to the solid angle, and that calculated according to the Kohschmieder formula are one and the same. It does not, in fact, allow the validity of extrapolation to 0 or 180 deg to be checked. Normalized scattering indicatrices for angles close to 0 and 180 deg and for visibilities 2 and 5 km are given. They are derived from a comparison of the Koitzik and Tschaeck diagrams with theoretical diagrams for power distribution. A power distribution is assumed to be in good accord with the available information on atmospheric aerosol structure.

5729 APTIC NUMBER 15889

Cherkov, N. A., G. Ye. Aristov, and D. L. Puklina
ABSORPTION OF SULFUR DIOXIDE FROM EXHAUST GASES IN A BUBBLING ABSORBER. (Pogloshchenie dvuokisi sery iz dymovykh gazov v absorbere barbotazhnogo tipa). Text in Russian. Khim. Prom., no. 1:19-25, 1956. 20 refs.

The absorption of sulfur dioxide from exhaust gases by an ammonium sulfite-bisulfite solution was studied in a 220 mm diameter model comprised of 4-6 grids with an aperture of 4-5 mm; 99% removal of SO2 with concurrent saturation of the absorption solution is reported with six grids, a linear gas flow of 1.5-2.4 m/sec and a total tower resistance of 150-200 mm H2O at 30-33 C. Foaming was conditioned not only by the absolute gas velocity in the grid apertures or in the absorber cross section, but also apparently by the ratio between these velocities. With the arrangement studied, this ratio varied from 5 to 6. The coefficient of SO2 absorption rate increases in direct proportion with the resistance of the solution layer on the grids and decreases with a decrease in the chemical capacity of the solution reaching the grid. This coefficient in terms of unit volume of bubbling column is 10-12 times greater than for a packed absorber. It is noted that the bubbling process has practically no tendency to increase the rate of absorption of poorly soluble gases, and in the case of oxygen, the degree of oxidation of the solution is several times lower than in a packed absorber.

5730 APTIC NUMBER 18888

Chipman, John
ACTIVITIES IN LIQUID METALLIC SOLUTIONS. Faraday Soc. Discussions, vol. 4:23-49, 1948. 56 refs.

The concept of activity and its thermodynamic equations were reviewed. The well-known methods for determining activities were illustrated with data on liquid metallic solutions. The concept of semi-regular solutions was introduced and its usefulness for metals demonstrated. Several useful empirical methods of treatment of activity data were employed. It was pointed out that this paper is not a complete review of the literature on activity, but should serve as an introduction to the literature on metallic solutions and as a stimulus to wider use of the activity concept in metallurgical problems. (Author conclusions modified)

5731 APTIC NUMBER 18751

Chufarov, G. I., N. V. Agafonov, Ye. P. Tatiyevskaya, and E. I. Kul'pina
EFFECT OF POROSITY OF SILICA GEL AS A CATALYST CARRIER ON THE RATE OF OXIDATION OF SULFUR DIOXIDE. (Vliyaniye poristosti silikagelya kak nositelya katalizatora na skorost' okisleniya sernistogo gaza. I). Text in Russian. Zh. Fiz. Khim., 5(7):936-945, 1938. 18 refs.

It was determined experimentally that the porosity of silica gel has a great effect on the rate of SO2 oxidation with platinum catalyst. At 440 C, the SO3 yield increased from 42% to more than 98% as porosity was increased from 20% to 70%. This effect was greater at lower temperatures and less noticeable at higher temperatures. Results for process temperatures ranging from 360 to 520 C with porosity values from 19% to 117.7% are reported. Sulfur trioxide yield had a tendency to drop as porosity was increased above 100%.

5732 APTIC NUMBER 18626

Chzhi-tsayn, Syao, V. I. Smirnov, and I. T. Sryvalin
THERMODYNAMICS OF SULFATE ROASTING OF CONVERTER SLAGS IN A

ROLLING LAYER. (Termodinamika protsessov sul'fatizirugshchego obzhiga konverternykh shlakov v kipyashchem sloye). Text in Russian. Tr. Ural'sk. Politekhn. Inst., no. 98:67-71, 1960. 9 refs.

Data from the literature are used to make thermodynamic calculations for reactions of elemental metals (nickel, cobalt, copper, iron), metal sulfides, metal oxides, and metal oxide-silicon dioxide complexes with sulfuric acid and sulfur dioxide at 573-973 K. Isobaric potential is plotted for a number of reactions. Reaction of metals with sulfuric acid is in the sequence: cobalt, nickel, copper. Isobaric potentials for reactions between metal sulfides and sulfuric acid are comparable for iron, cobalt, and nickel but considerably higher for copper. The reaction sequence for the sulfating of metal oxides is found to be: cobalt, nickel, copper, iron. Sulfating of silicates is characterized by much more negative isobaric potentials, being nearly the same for iron, cobalt, and nickel. It may be concluded that under similar conditions, oxides, metals, and sulfides will sulfate more readily than will silicates, ferrites, and aluminates. It is noted that the drop in isobaric potential decreases with increasing temperature in the case of sulfur dioxide but increases with sulfuric acid, the isobaric potential plots intersecting at 450-500 C. Hence, sulfation with sulfuric acid will predominate at practicable roasting temperatures (600-700 C).

5733 APTIC NUMBER 18738

Clodi, P. H., H. Prischauf, F. Resendorfer, and H. Schnack
UPTAKE AND ELIMINATION OF TRACE ELEMENTS BY THE PERFUSED RAT LIVER. (Aufnahme und Ausscheidung von Spurenelementen durch die perfundierte Rattenleber). Text in German. Wien. Klin. Wochschr., 80(21):417-419, May 24, 1968. 7 refs.

For testing the intake of Fe, Mn, and Zn by the liver and their discharge into the gallbladder, the livers of rats were isolated and perfused according to Brauer's technique. The perfusion solution consisted of 50 ml heparinized rat blood, human albumin, and 120 ml of a buffer solution. The bile produced by the perfused liver was collected for analysis and the results were compared with in vivo experiments with rats after intravenous injection of the trace metals. By addition of radioactive isotopes of the above elements, the disappearance rate from the blood and the discharge with the bile could be determined. Discharge of the heavy metals varied with each, while retention and storage in the liver was the same for all. Radioactive iron disappeared from the perfusion medium within 2 min, radioactive manganese within 30 min, and the radioactivity of zinc remained in the medium. Intake of zinc by the liver was more pronounced in the in vivo experiments. About 10% of the Mn and only several mgm of Fe and Zn were discharged into the gallbladder.

5734 APTIC NUMBER 15755

Comtat, Maurice and Jean Mahenc
ELECTROCHEMICAL OXIDATION OF SULFUR DIOXIDE ON A PLATINUM ELECTRODE. (Oxydation electrochimique du dioxyde de soufre sur electrode de platine). Text in French. Bull. Soc. Chem. France, no.11:4462-9, 1969. 23 refs.

Electrochemical oxidation of sulfur dioxide on a platinum electrode was undertaken by various potentiostatic and potentiodynamic methods. Two types of oxidation were evident: a purely electrochemical oxidation which depended essentially on the surface state of the electrode, and particularly on the state of reduction of the superficial film of platinum oxide generated eletrolytically; the second type of oxidation is linked with the presence of this platinum oxide which involves a phenomenon of passivation. Different mechanisms which are susceptible to passivation phenomena were proposed to account for the experimental results; a systematic method of calculating current-voltage curves is presented, using the coefficient of transfer and Temkin's factor as parameters.

5735 APTIC NUMBER 15122

Cosby, William Trevor and Clive Richard Smith
PROMOTION OF CHEMICAL REACTIONS BY ELECTRICAL DISCHARGE. (Holmes (W. C.) & Co. Ltd., Huddersfield, England) Brit. Pat. 1,009,331. Jn., May. 1965. (Appl. Nov. 12, 1960, 15 claims).

A method of inducing a chemical reaction is described in which the reactant is subjected to a diffused electrical discharge produced by the application of a high-frequency, high-voltage supply between a pair of electrodes having at least one dielectric screen imposed between them. The power of the diffuse discharge is greater than 7.2 watts/cu cm, as produced by a voltage of several KV and a frequency of several hundred Kc/sec. Such an electrical discharge may be applied with or without a catalyst being present. Each screen is formed from a dielectric material having a high melting or softening point in the case of local heating; quartz, fused silica, or ceramic or mica compositions can be used. By the insertion of the screen or screens between the electrodes, the discharge passes between each screen and each pair of electrodes, diffusing the discharge and preventing flash-over. To demonstrate the principle, the oxidation of sulfur dioxide to sulfur trioxide is described.

5736 APTIC NUMBER 13553

Cronan, C. S.
OVI SPRINTS TANDEM PULLS...HIGH PURITY AROMATICS FROM COKE-OVEN OIL. Chem. Eng., 66(2):110-113, Jan. 12, 1959.

The Jones and Laughlin Steel Corp. has been successfully producing high-purity aromatics from crude coke oven light oils since 1957. The light oil is produced during the high temperature carbonization of coal to make metallurgical coke, and is recovered from the coke oven gas by scrubbing with an absorbent oil. It is then sent to stripping towers to remove carbon disulfide and other light ends. After pretreatment, the light oil is heated and fed to a Hydrofiner reactor. After caustic scrubbing, benzene, toluene, and

xylene products are separated from gases and sent to a stream stripper where residual H2S is removed; they then proceed to Udex extraction. The Udex process extracts aromatics from paraffins using aqueous diethylene glycol, then strips pure aromatics from the glycol. Final fractionation of the finished products is done in three towers: two continuous towers for benzene and toluene, and a batch column for xylene. A flowsheet illustrating the process of hydrofining and extraction is included.

5737 APTIC NUMBER 15045

Crosley, David R.
USE OF OPTICAL PUMPING TO DETECT FREE RADICALS DURING A GAS-PHASE PHOTOLYSIS. J. Chem. Phys., 47(8):1361-1368, Aug. 15, 1967. 32 refs.

An optically pumped system of rubidium was used as a probe to measure the concentration of free radicals present during the vacuum-ultraviolet photolysis of five hydrocarbons. The mechanism for this measurement is the reduction of the relaxation time of the oriented rubidium in the presence of radicals, due to the large spin exchange interaction between the two species. Measurements were made at two different pressures each on methane, ethane, propane, butane, and isobutane and both relative and absolute approximate quantum yields for radical production were determined. Separate detection of hydrogen atoms during the photolysis, through spin exchange coupled electron spin resonance is discussed. This method of directly detecting free-radical intermediates appears to be a useful complement to standard experiments in which reaction mechanisms are deduced from analysis of final products of the photolysis. (Author abstract modified)

5738 APTIC NUMBER 10783

Cunningham, J. C. J.
THE SYSTEM: LEAD OXIDE-COPPER OXIDE. PRELIMINARY RESULTS. (Das System: Bleioxyd-Kupferoxyd. Vorlaeufige Mitteilung). Text in German. Z. Anorg. Chem., 89(1):48-52, 1914. 7 refs.

The possible existence of chemical bonds between lead oxide and copper oxide was investigated. First, the melting point of the lead oxide was determined by heating in a platinum container to be 875 C. Next, the melting points of mixtures of lead oxides with copper oxides were determined. The platinum vessel and contents were heated to 980 C, at which temperature the entire composition was liquid. The lead oxide was determined in the form of lead sulfate, and the copper oxide was determined electrolytically as copper. The melting point of the lead oxide dropped upon addition of copper oxide. It was found that no compounds formed from the molten mixture of lead oxide and copper oxide, at least not as PbO.CuO or 2PbO.CuO. A eutectic mixture formed which melted at 698 C.

5739 APTIC NUMBER 15528

Curran, George P. and Everett Gorin
PHASE II: BENCH-SCALE RESEARCH IN CSG PROCESS. LABORATORY PHYSICO-CHEMICAL STUDIES. (Interim Report.) Consolidated Coal Co., Library, Pa., Research Div., OCR Contract 14-01-0001-415, R & D Rept. 16, 58p., 1968. 9 refs.
CPSTI: PB 188719

Basic physico-chemical data important to the development of the CO2 acceptor process are given. Kinetic and integral rate data for lignite char gasification were obtained at 1500 F and 16 atm for two gas inlet compositions. These data show both the strong inhibiting effect of H2 and the catalytic effect of sodium on the gasification rate. The highest sodium content char was the most reactive, but its reactivity was reduced by water extraction to remove the major fraction of sodium. Differential rate data at 1500 F were obtained with a single lignite char at 11 and 16 atm over a wide range of gas compositions. Rates of formation of carbon oxides and methane were measured. Both rates were inhibited by H2 as well as CO. The use of the acceptor showed a favorable effect on the rate of both the carbon steam and methane rates, since the acceptor action reduces the partial pressure of strongly inhibiting CO. The lignite chars showed an unusually high rate of methane formation with pure hydrogen at temperatures of 1800-1500 F which was suppressed by the presence of a small quantity of steam. Phase equilibrium data from the literature were reviewed, and new data were presented in the binary Ca(OH)2-CaCO3 system. The presence of low-melting eutectics limited practical fluid bed operations to steam partial pressures of 11 atm or below. Agglomerates were formed in the fluid bed above 11 atm, and actual melts were produced above 16 atm. The use of the Ca(OH)2-CO3 system makes either the preparation of synthetic lime or the reactivation of spent lime or dolomite acceptors possible. The reconstituted acceptors are physically strong and their activity is almost equivalent to fresh limestone. Physical studies pointed out that the major cause of activity loss was the growth in size of CaO crystallites. The rapid segregation of the CaO and MgO phases occurred early in the cycling of dolomite acceptors. Acceptors agglomeration in the regenerator occurred when it was operated without char combustion. Microprobe studies showed that it was due to sintering of an outer shell material enriched by Fe, Si, and Al, and was prevented by the addition of ash. (Author summary modified)

5740 APTIC NUMBER 15053

Dahler, John S. and Norman F. Sather
KINETIC THEORY OF LOADED SPHERES. I. J. Chem. Phys., 38(11):2363-2382, May 15, 1963. 16 refs.

A rigorous formalism is developed for the theory of transport in fluids composed of loaded-sphere molecules. From this theory, formulas are derived for the fluxes of mass, linear momentum, internal or spin angular momentum, and energy. The existence of inverse collisions is established and used to prove a weak form of the Boltzmann H theorem. A kinetic theory is presented for dilute multicomponent mixtures of loaded spheres and are derived explicit formulas for the

phenomenological gas transport coefficients. Since the only critical assumption imbedded within this treatment is that of molecular chaos, it appears that the theory for loaded spheres shares the 'rigor' of the Chapman-Enskog theory for structureless molecular species. (Author abstract modified)

5781 APTIC NUMBER 14621

Balmau Gimenez, Francisco
STUDY ON HEAT RECOVERY IN PYRITE ROASTING. (Etude de la recuperation de la chaleur produite au cours du grillage de la pyrite). Text in French. Genie Chim., 89(4):111-117, April 1963. 8 refs.

Pyrite roasting in mechanical stage furnaces and fluidized beds is considered in terms of the problems associated with the recovery of the perceptible heat from the gases. A new process for recovering heat in a multi-stage furnace permits the use of ordinary water tubes and eliminates the need for special cleaning devices. There is no formation of scale deposits. Regardless of the furnace employed, the process follows two preliminary stages. In the first, the pyrite loses a sulfur atom in the form of vapor which burns on contact with air, giving place to sulfide intermediates (pyrrhotine). In turn, the intermediates lose part of their sulfur and at the end of this stage exist almost completely as ferrous sulfides. These first stage reactions are expressed by the following equations: 7FeS2 plus 6O2 yields Fe7S8 plus 6SO2 and Fe7S8 plus O2 yields 7 FeS plus SO2. The amount of sulfide intermediates produced depends partly on temperature and volume of air administered. The result of the first stage is expressed as FeS2 plus O2 yields FeS plus SO2 plus 470 kcal/kg of FeS2. Roasting of the ferrous sulfide in the second stage takes place according to the reaction 4FeS plus 7O2 yields 2Fe2O3 plus 4SO2 plus 1240 kcal/kg of FeS2. Since impurities are eliminated from the pyrite, the gases produced in subsequent stages are practically free from impurities and suited to the recovery of their perceptible heat.

5782 APTIC NUMBER 15193

Banatos, Steve
MINERAL SEPARATIONS. Chem. Eng., 71(25):155-168, Dec. 7, 1964. 19 refs.

Methods for separating relatively homogeneous mixtures are zone refining, adsorption on molecular sieves, diffusion, ion exchange, dialysis and electrodialysis, electrophoresis, chromotography, dissociation extraction, thermal diffusion, and foam fractionation. The principles of these techniques are reviewed. Zone refining is a method for producing extremely pure materials by recrystallization. The main advantages of zone refining are simplicity, complete recovery of starting materials, purification without the use of extraneous reagents, and no need for physical separation of the pure and impure fractions after each pass through the furnace. The disadvantages include the inability to purify all of the starting material, the use of small quantities, and batch operation requiring relatively long time per unit of finished product. Selective adsorption provides a method for the separation of materials with almost identical chemical and physical properties and for the dehydration of certain process streams. Molecular sieves effect the separation of water from a variety of gas and liquid streams. Dialysis and electrodialysis accomplish separation across a permeable membrane under a driving force that is either a concentration or an electrical gradient. Gaseous diffusion can occur in single or multiple stages. Thermal diffusion is the separation of a homogeneous solution into its components by means of a temperature gradient. Separation by chromotographic methods depends on the retention and distribution of the solutes in a mixture by a two-phase system in which a fluid phase moves relative to the other. This technique can be used for the resolution of the components in hydrocarbon streams. Application of foam fractionation to the effluents from sewage plants enables the separation of the detergents present in sewage. Electrophoresis is a powerful analytical method for the separation and identification of many complex substances, but is slow and the quantitative amounts of components separated are small.

5783 APTIC NUMBER 14905

Danckwerts, P. V.
GAS ABSORPTION ACCOMPANIED BY CHEMICAL REACTION. Am. Inst. Chem. Engrs. J., 1(4):456-463, Dec. 1955. 26 refs.

A review of given processes of gas absorption occurring on the liquid side of the interface when gases are absorbed by liquids, and by reactive liquids in particular. Reference is made mainly to absorption in the type of equipment often used industrially, although much of the discussion also has some bearing on absorption under other circumstances, for example at the surface of a stirred liquid or rising bubble. Several different types of model proposed for the processes which control the rate of absorption are evaluated. With few exceptions, only rough estimates can be made of the performance of packed towers and similar absorbing equipment when reacting liquids are to be used: conventional calculation methods, based on film and penetration theories of absorption, fail because they employ oversimplified models of the hydrodynamic behavior of the liquid. These models involve only two parameters: the effective wetted surface area per unit volume of packing and the liquid-film coefficient for physical absorption. Development of more elaborate models on which sufficiently accurate methods can be based is contingent on a knowledge of the mechanism involved in the flow of a layer of liquid over discontinuous surfaces, and on measurements of the transient absorption rates of the agitated liquids.

5784 APTIC NUMBER 14880

Danckwerts, P. V.
SIGNIFICANCE OF LIQUID-FILM COEFFICIENTS IN GAS ABSORPTION. Ind. Eng. Chem., 43(6):1460-1467, June 1951. 6 refs.

A theory of the gas absorption process is suggested which is more plausible than the present theory which is based on an

unrealistic picture of the absorption mechanism and which can be misleading when used to predict the behavior of systems for which there is no experimental data. The usual assumption of a stagnant film of liquid at the interface was abandoned. Instead, it was supposed that the surface is continually being replaced with fresh liquid. A theory of absorption rates was mathematically developed on this basis. It appeared to agree generally with experience, but it must be regarded as tentative until confirmed experimentally. If the detailed features of the theory are confirmed, it offers a powerful method of predicting the performance of absorption equipment. Failing this, it may still provide suggestions for a new method of approach to the subject. (Author abstract modified)

5745 APTIC NUMBER 14922

Danckwerts, P. V.
THE ABSORPTION OF GASES IN LIQUIDS. Pure Appl. Chem., 10(4):625-642, 1965. 20 refs.

The process of gas absorption, which is important in minimizing plant design and operating costs, is discussed in terms of absorption in packed columns and absorption of carbon dioxide by various solutions. Many of the conclusions are applicable to other types of equipment and other more complicated solutes. The physical absorption of CO2 into water or some other liquid with which it does not react is considered, and various 'surface renewal' models, which suppose that parts of the liquid surface are from time to time replaced by fresh liquid brought up from the bulk of the layer, are described. The reactions involved in the absorption of gases into liquids with which they do react chemically are considered at length. Such absorption is used either to obtain the products of the reaction for their own sake, as with propylene chlorhydrin, or to remove one constituent from a mixture of gases. In this case, the chemical reaction speeds up the absorption process and the liquid can absorb more gas; both factors are cost-reducing. The reactions of CO2 when absorbed in water and in solutions of sodium hydroxide, potassium carbonate, and any one of several amines, and the application of these types of reactions to plant design, are elaborated. Some experimental work with absorption in packed columns is described; and it is concluded that it is possible to use the film or surface renewal models to predict absorption rates in packed columns if values of kL, the liquid film coefficient, and a, the effective interfacial area, are known. Three methods of applying these models are described. In the absence of these data, it seems probable that rates of absorption can be predicted from very simple experiments in the laboratory which reproduce the value of kL but not necessarily any of the other features of the full-scale plant.

5746 APTIC NUMBER 14622

Dauba, J. L.
MAXIMUM TEMPERATURES ATTAINABLE BY COMBUSTION OF CARBON AND METHANE IN AIR. (Temperatures maximales accessibles par combustion du carbone et du methane dans l'air). Text in French. Genie Chim., 92(4):102-110, Oct. 1964. 4 refs.

A thermodinamic study made possible the prediction of te effects of preheating of combustibles and supporters of combustion as well as the influence of the combustible/combustion supporter ratio, burning methane and carbon, respectively, in air. A simple approximation to account for calorific losses in the heat exchanger during preheating is possible if it is assumed that heat losses are mainly due to radiation. The combustible/combustion supporter ratio is much more important in the carbon-air system than in the methane-air system.

5747 APTIC NUMBER 14857

Davidson, Burton and George Thodos
KINETICS OF THE CATALYTIC OXIDATION OF SULFUR DIOXIDE. A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 10(4):568-573, July 1964. 21 refs.

The Hougen and Watson approach was applied to the analysis of kinetic data obtained for the catalytic oxidation of sulfur dioxide over a commercial vanadium pentoxide catalyst. The results indicate that the rate-controlling step involves a surface reaction between chemisorbed sulfur dioxide and chemisorbed atomic oxygen to produce chemisorbed sulfur trioxide and a vacant site. This approach directly accounts for the presence of all the reacting and product constituents, including nitrogen. The temperature dependence of the resulting reaction velocity constant and adsorption equilibrium constants is consistent with the theory of absolute reaction rates. Although a power-law expression is capable of predicting rates with essentially the same degree of accuracy, its application must be limited to the range of conditions of the experimental data used to develop this expression. The theoretically based steps of Hougen and Watson give rise to a model that produces compatible consequences that are of a more basic nature and bridge the gap between complete empiricism and the complex adsorption interactions and chemical reactions occurring on the surface of the catalyst. Although the Hougen and Watson approach includes certain inherent weaknesses, it offers the most comprehensive available approach to this subject. Attempts to improve on this model should constitute an advancement for the better understanding of the mechanics of catalytic reactions. (Author conclusions modified)

5748 APTIC NUMBER 14625

Davtyan, O. K., M. A. Manakin, and F. G. Misyuk
TEMPERATURE DEPENDENCE OF SULFURIC ACID FORMATION RATE DURING CATALYTIC OXIDATION OF SULFUR DIOXIDE ON ACTIVATED CARBON BY THE WET CONTACT METHOD. (Temperaturnaya zavisimost' skorosti obrazovaniya sernoy kisloty pri kataliticheskom okislenii sernistogo angidrida na aktivirovannom ugle zhidkostno-kontaktnym metodom). Text in Russian. Nauchn. Ezhegodnik Odessk. Gos. Univ., Khim. Fak., no. 2:113-115, 1961. 2 refs.

The formation of sulfuric acid was studied experimentally in a laboratory percolating device in which an incoming SO2-O2 mixture serves to lift the solvent so that it trickles over the

catalyst before returning to the solvent reservoir. The partial pressures of the gas mixture were 200 and 400 mm Hg in two series of experiments over 10 deg temperature intervals ranging from 0 to 60 C. The temperature coefficient in all cases varied from 1.2 to 1.3, i.e., within the range typical for a diffusion process.

5749 APTIC NUMBER 13726

de Cormis L., J. Cantuel, and J. Ponte
BUILDING OF A FUMIGATION ENCLOSURE FOR TRIALS ON ARTIFICIALLY POLLUTED ATMOSPHERE. (Realisation d'une enceinte a fumigation pour des essais d'atmosphere artificiellement polluee). Text in French. Poll. Atmos. (Paris), 11(42):78-79, April/June 1969.

A semi-air-conditioned, cyclindrical enclosure, built to study the effect of air pollution on vegetation, holds constant and adjustable amounts of SO2 and HF. Air can be renewed 125 times an hour in volumes up to 1.35 cu m. The system permits not only studies of short duration (one to four hours), but also semi-automated experiments lasting several weeks. The action of a single pollutant can be observed, or several pollutants, including nitrogen oxides and ozone, as well as sulfur dioxide and hydrogen fluoride, can be studied simultaneously. (Author summary modified)

5750 APTIC NUMBER 14686

de Forcrand, P. and P. Tabourv
SULFONES FORMED BY THE IODIDES OF SODIUM, RUBIDIUM AND CESIUM. (Sur les sulfones formees par les iodures de sodium, de rubidium et de caesium). Text in French. Compt. Rend. Acad. Sci. (Paris), 168(25):1253-1257, June 23, 1919. 11 refs.

The absorption of sulfur dioxide by dry sodium iodide, rubidium iodide, or cesium iodide was studied. At ordinary temperatures of 15-20 C, there is only a slight reaction. At lower temperatures or at -10 to -23 C and with liquid sulfur dioxide, two products are obtained-a yellow solid and an orange liquid. However, in the presence of excess liquid sulfur dioxide, the solid substances formed with rubidium iodide and cesium iodide disappears, indicating that these products are soluble in sulfur dioxide. Analysis of the solid products indicated that they had the following formulas: NaI plus 3SO2; RbI plus 3SO2; and CsI plus 3SO2.

5751 APTIC NUMBER 15011

de la Garza, Andres, G. A. Garrett, P. L. Woglund, and Edward Von Halle
A GENERALIZED CASCADE FOR MULTICOMPONENT ISOTOPE SEPARATION. Chem. Eng. Progr. Symp. Ser., 61(55):27-33, 1965. 1 ref.

The problem of extending the cascade theory to the separation of multicomponent mixtures of isotopes can be approached by designing the cascade in such a way that the ratios of the concentrations of two specified components are identical whenever streams are mixed. If the concentrations of these two components in the feed stream are allowed to vanish so that their abundance ratio remains constant, any two dummy components can be chosen for the matching of the abundance ratio. This property allows the engineer to choose the cascade which more nearly approaches the desirable minimum power cascade than either matched combination cascades or ordinary matched abundance cascades designed to perform a given multicomponent separation task. Furthermore, the major cascade variables can be explicitly calculated by a set of simple equations. These equations for product and waste concentrations, and summation of interstage flows, are written in terms of the parameter which is the arithmetic mean of the molecular weights of the two dummy components. In principle, this parameter indicates a means whereby any component of a multicomponent mixture may be isolated. The equations are illustrated by application to a plant designed for the production of enriched tungsten.

5752 APTIC NUMBER 15117

De La Garza, A.
A GENERALIZATION OF THE MATCHED ABUNDANCE-RATIO CASCADE FOR MULTICOMPONENT ISOTOPE SEPARATION. Chem. Eng. Sci., 18(2):73-82, 1963. 10 refs.

A generalization of the previously reported matched abundance-ratio cascades for multicomponent isotope separation is presented. Matched abundance-ratio cascades match the abundance ratio of two components, called key components, of the processed mixture wherever streams are mixed. The new cascades, called constant key weight cascades, are matched abundance-ratio cascades, with dummy key components. Formulas for the resolution of the productivity of a three-stream constant key weight cascade are given; these eliminate iterative computations previously necessary to balance out the cascade in all components. The separation characteristics of constant key weight cascades are conveniently controlled by the key weight, which is the arithmetic mean of the molecular weights assigned the dummy key components; examples are given. Permitted variation of the key weight is also of use in cascade optimization, and is discussed both for an end component and a middle component separation. (Author abstract modified)

5753 APTIC NUMBER 14509

DeFord, Donald D. and David N. Hume
THE DETERMINATION OF CONSECUTIVE FORMATION CONSTANTS OF COMPLEX IONS FROM POLAROGRAPHIC DATA. J. Am. Chem. Soc., 73(11): 5321-5322, Nov. 1951. 5 refs.

A method for the mathematical analysis of the change in half-wave potential of a metal ion with changes in the concentration of the complexing agent was derived. The identification of the successive complex ions formed and the determination of their formation constants are made possible by this method. Application of the method, ignoring all activity coefficients, gave formation constant values which indicated one or more

higher complexes of relatively low stability. It was felt that although the data did not justify quantitative interpretation beyond the first two or three formation constants, the essential validity of the method was demonstrated.

5754 APTIC NUMBER 18755

Delafosse, Denise, Pierre Barret, and Jean-Dominique Joffrin
RELATION BETWEEN THE ELECTRICAL AND CATALYTIC PROPERTIES OF NICKEL DISULFIDE. (Relation entre les proprietes electriques et catalytiques du disulfure de nickel). Text in French. Compt. Rend. (Paris), vol. 256:1531-1534, 1963. 5 refs.

The electrical conductivity of nickel disulfide was studied as a function of temperature. The influence on the conductivity of the chemisorption of such gases as oxygen, hydrogen sulfide, water vapor, sulfur dioxide, and ethylene was studied. Oxygen above 150 C at a pressure of 10 mm Hg decreases conductivity as the temperature is increased. With hydrogen and hydrogen sulfide, a conductivity increase began at 200 C. Water vapor was comparable to hydrogen sulfide. In each of these cases, the process was one of free proton capture. Ethylene was comparable to oxygen.

5755 APTIC NUMBER 18390

Delyagin, G. N.
ANALYSIS OF HEAT LOSSES FROM DISCHARGE GASES DURING THE COMBUSTION OF A WATER-COAL SUSPENSION. (Analiz poter' tepla s ukhodyashchimi gazami pri szhiganii vodougol'noy suspenzii). Text in Russian. Szhiganiye Vysokoobvodn., Topl. Vide Vodougol. Suspenzii, 1967:166-174. 11 refs.

Heat losses from the combustion products of five different coal types (three from Donbas and one each from the Kuznetsk and Podmoskov basins) in water suspension were analyzed, taking into account moisture, ash, and sulfur contents of the fuel, as well as the volume of water vapor and combustion products released. Analysis was made by reducing the dew point during the combustion of sulfurous mazuts and bituminous coal. Conducting the combustion of water-coal suspensions with a 1.05 air excess makes it possible to hold heat losses from the discharge gases at a level typical for modern boiler installations operating with dry pulverized fuel. Data for this analysis were taken from the literature.

5756 APTIC NUMBER 18919

Denbigh, K. G.
THE HEAT OF TRANSPORT IN BINARY REGULAR SOLUTIONS. Trans. Faraday Soc., vol. 48:1-8, 1952. 10 refs.

The thermodynamic and kinetic theories of thermal diffusion in binary liquid mixtures are compared. According to the former theory, the magnitude of the Soret effect is determined by heats of transport of the components; in the latter, it is determined by energies of detachment and of hole formation in the liquid. An approximate interpretation, in terms of the molecular interaction energies, of the thermodynamic treatment of the Soret effect is based on the model of regular solutions used by Fowler and Guggenheim and by Rushbrooke. It assumes that, when a molecule diffuses through the reference plane, the energy which must be provided is a certain fraction of the change in potential energy for complete detachment. Changes in vibrational and other forms of kinetic energy in passing through the transition state are thus disregarded. This can be strictly true only near the absolute zero, but is probably a good approximation even at room temperature. Therefore, the total energy for complete detachment, i.e., vaporization at room temperature, does not differ greatly from the change in potential energy alone. The equations obtained satisfy the requirements of the thermodynamic theory.

5757 APTIC NUMBER 18360

Dickson, D. J.
THERMAL CONDUCTIVITY OF BARYTES AND CHROME DUST - INFLUENCE OF PARTICLE SIZE. Electricity Council Research Centre, Chester, Eng., Job 611, Rept. ECRC/M136, 9p., Dec. 1968.

New types of storage heaters require moderately effective thermal insulation having a higher heat capacity than conventional insulators. Barites and chrome dust were suggested to satisfy this requirement. The influence of particle size on the thermal conductivity and packing density of barites and chrome dust was determined. Particle diameters of chrome dust were in the range of 1 micron to 2 mm. Barites were either ground or micronized. Measurements were made at two temperatures (approximately 500 C and 800 C) for each grade powder. No shrinkage or sintering occurred during the measurement. The absolute accuracy of the results was plus or minus 5%. It was concluded that by sieving crude chrome dust, a 40% reduction in thermal conductivity is obtained. Micronized barites, although seven times as dense, have a conductivity approaching that of a good insulator, such as micronized sepiolite. If thermal conductivity is plotted against density, a smooth curve results for both materials in the density range 1800-2800 kg/cu m. Both barites and chromite have specific gravities around 4.5 so that the density scale can be converted to a common voidage scale.

5758 APTIC NUMBER 18688

Dimov, Nano Pentschev
CHROMATOGRAPHY OF THE LIGHT GASES ON METAL-SUBSTITUTED SILICA GELS. (Chromatographie der leichten Gase auf metallermetzbaren Silikagelen). Text in German. Abhandl. Deut. Akad. Wiss. Berlin, Gas-Chromatog. 1966, no. 2:C133-C136, 1966. 16 refs.

On silica gels whose hydroxyl group hydrogens had been replaced by metal ions, the chromatographic separation of a mixture of methane, ethane, ethylene, propane, propylene, and butane were studied. It was expected that on silica gels containing -OAg, -ONa, and -OK groups, polar propylene and polarized ethylene would be retained. However, the alkali metals lead to

a reduction of the retained volumes of ethylene and propylene. The alkali earth metals (Ca, Ba) reduced the effect of the hydroxyl groups but not as strongly. Propylene appears between iso-butane and n-butane. Silica gel Cu and silica gel Ag did not pass the olefins at 30 C and with a pressurized carrier gas for 30 min. Silica gel treated with Ag ions was used for analysis of ethane traces in ethylene or of propane and butane traces in propylene. It was found that at 20 C, 20 ml of ethylene can be passed through 8 g of silica gel containing 8 mole % of silver without obtaining any peaks. With larger quantities (50 ml), an ethylene peak is developed in the same time as needed with non-treated silica gel, but this peak is so small that it does not interfere with the quantitative evaluation of the other peaks.

5759 APTIC NUMBER 15601

Diomaiuto-Bonnand, Janine and Danielle Nicolas-Prat
STRUCTURE AND EVOLUTION OF NEOFORM BUDS IN VITRO. NEOFORM BUDS ON THE FLORAL STEM OF NICOTIANA SYLVESTRIS DURING THE INDUCTIVE PHOTOPERIOD. (Structure et evolution des bourgeons neoformes in vitro. Bourgeons neoformes sur hampe florale chez le Nicotiana sylvestris en photoperiode inductive). Text in French. C. R. Acad. Sci., Paris, Ser. D, Vol. 265: 1482-1484, Nov. 13, 1967. 6 refs.

The in vitro evolution of neoform buds on the callus in Nicotiana sylvestris starts with fragments of the floral stem. The process is similar to that observed for apical meristems of whole plants. Blooming does not occur in the inductive photoperiod and evolution stops; the apex, which has formed about 30 leaves, is typically vegetative. The fragments were cultured in nutrient medium in a phototron.

5760 APTIC NUMBER 14399

Bioszeghy, D.
THEORETICAL AND PRACTICAL DEVELOPMENT OF FLAME RESEARCH. (Theoretische und praktische Entwicklung der Flammenforschung). Text in German. Freiberger Forschungsh. B, no. 120: 183-200, 1967. 15 refs.

Historical development and fundamentals of flame research are reviewed. With respect to the microstructure of flames, burning velocity and the importance of secondary air in reducing the flame are discussed. Pertinent experiments in Hungary were concentrated on the study of the combustion for natural gas, the main fuel in the steel industry. Formation of scale can be avoided if stoichiometric combustion and uniform flame temperature are maintained. The effect of secondary air was studied by means of a ceramic flame tube. The gases were analyzed by gas chromatography with CO2 as carrier gas. It was found that the least amount of scale is formed when (CO2/CO) plus (H2O/H2) is less than one. Larger experiments were conducted in a chamber furnace where 14.8 cu m natural gas per hour were burned with 130 cu m air per hour. Heating tests were performed with 30 mm brass blocks. In furnaces with radiative heat transfer, it is important to destroy the boundary layers at the walls. This is done by sucking the flue gases through openings in the walls. Thirty such furnaces were constructed and they now operate in forges throughout the country. The wall temperatures in these furnaces are typically 1080 C without wall channels and 1250 C with wall channels.

5761 APTIC NUMBER 14352

Divey, N. P., V. V. PaducheV, V. V. Toporova, and N. P. Ospenskiy
REACTION OF CERTAIN SULFIDES WITH SULFUR DIOXIDE AND SULFATES. (Vzaimodeystviye nekotorykh sul'fidov s sernistym angidridom i sul'fatami). Text in Russian. Doklady Akad. Nauk SSSR, 178(2): 382-384, 1968. 13 refs.

Sulfur 35 isotope was used in a study of the reaction of certain sulfides with sulfur dioxide (600-1100 C) and sulfates (900 C). It was found that the sulfur of calcium sulfide is completely replaced by that of sulfur dioxide in producing calcium sulfate. In a closed system with cobalt sulfate and circulating SO2, radioactivity became balanced between S2 and SO2; results for FeS were similar. Reaction between CaS and CaSO4 yielded one fourth radioactive SO2 regardless of which of the starting compounds contained radioactive sulfur. Four new secondary reaction equations were established: MeS* plus 2SO2 yields MeS2O4 plus S*; MeS2O4 yields MeSO4 plus S; MeS* plus 3MeSO4 yields 4MeO plus 4SO2 plus S*O2; and MeS* plus MeSO4 yields 2Me plus SO2 plus S*O2.

5762 APTIC NUMBER 15536

Dodonova, N. Ya. and V. V. Soboley
INFRARED EMISSION OF NITRIC OXIDE IN ELECTRICAL DISCHARGE. Vestn. Leningr. Univ., Ser. Fiz. i Khim., 2(10): 3-5, 1956. 8 refs. Translated from Russian. Dept of the Army, Fort Detrick, Frederick, Md., Sp., Aug. 1956.
CFSTI, DDC: AD 692563

The emission of nitric oxide in an electrical discharge at pressures of 10-200 mm Hg was studied. Nitric oxide was produced by a solution of KNO2 + KI reacting with dilute sulfuric acid and was dried with phosphorus pentoxide and sulfuric acid. The emission spectrum obtained from the discharge had maxima at 3, 5.4, and 5.8 microns. Comparison of the NO emission spectrum with the absorption spectra of NO showed that the bands which were detected do not belong to NO, but to oxides of nitrogen formed in the discharge by decomposition of NO and by chemical reactions. The only exception may be the 3 micron band which could belong to NO. It was concluded that the addition of nitrogen to the nitric oxide in the discharge does not affect the emission intensity of the 5.8 micron band. This does not agree with previous views.

5763 APTIC NUMBER 14702

Doiwa, A. and A. Tomanek
THE FORMATION OF CADMIUM CARBONATE AND CADMIUM SULFITE FROM

CADMIUM OXIDE. (Die Bildung von Cadmium carbonat und Cadmiumsulfit aus Cadmiumoxid). Text in German. Z. Anorg. Allgem. Chem., 338(1-2):12-18, 1965. 5 refs.

The carbonatization of cadmium oxide was studied by treating CdO samples with extremely dry CO2 at room temperature in presence of NaCl, NaBr, or NaI. Under these conditions, no carbonate formation could be observed even after four weeks. In presence of water vapor, the samples with NaI carbonatized quantitatively after two days, and those with NaBr and NaCl carbonatized after four days. In the temperature range between 250 and 300 deg, carbonatization was complete only in the presence of NaI. Furthermore, the reaction was independent of the water vapor content of CO2. The reaction with gaseous SO2 was similar but faster than that with CO2.

5764 APTIC NUMBER 15054

Douglas, A. E.
ANOMALOUSLY LONG RADIATION LIFETIMES OF MOLECULAR EXCITED STATES. J. Chem. Phys., 45(3):1007-1015, Aug. 1, 1966. 15 refs.

Certain excited states of molecules have anomalously long radiative lifetimes compared with the values calculated from integrated absorption coefficients. Using the properties of the stationary states, four mechanisms which may account for such anomalous lifetimes in collision-free molecules are presented. Although the four mechanisms bear a one-to-one relationship to those which have been discussed using semiclassical concepts, certain consequences of the more exact treatment do not appear in the semiclassical approach. In particular, it is shown that the two mechanisms which are most important for polyatomic molecules lead to highly perturbed energy levels and correspondingly complex spectra. The spectra of NO2, SO2, and CS2 molecules, which have anomalously long lifetimes, also appear to have perturbed energy levels. This observation is in agreement with the concept that the long lifetimes arise from a mixing of the vibrational levels within one state or a mixing of the levels of two electronic states. An investigation of additional molecules should show further examples of anomalous lifetimes; it is expected that for some molecules, the various vibrational and rotational levels of one electronic state will show a wide range of lifetimes. It appears probable that all the effects attributed to intersystem crossing of collision-free molecules can also be treated in terms of perturbations of the stationary state of the molecule.

5765 APTIC NUMBER 15280

Dravnieks, A. and R. K. Krotoszynski
DETECTION AND IDENTIFICATION OF CHEMICAL SIGNATURES. IIT Research Inst., Chicago, Ill., Technology Center, Contract DA-18-001-AMC-958(X), Final Rept. IITRI C6093-13, 171p., May 19, 1969.
AD 691738

In the work on the detection and identification of human chemical signatures, experimental and computerized statistical techniques were developed, tested, and standardized. The experimental techniques solved the problems of sample collection, recovery, injection into the gas chromatograph, calibration, and characterization of signature components. The sample collections were based on the principle of equilibration and were performed by means of Apiezon L-coated Teflon powder in the form of a fluidized bed. The collected samples were transferred into a special injector needle by means of an IITRI-designed transfer system. The injection of samples into the gas chromatograph was performed in a timed, automatic, and reproducible manner with a specially constructed injection system. The calibration method permitted correlation of the concentrations of known signature components in air with their respective peak areas. The sensitivity of this novel process is of the order of 1 ppb of an organic component in air. The developed techniques were used to collect and analyze vapor samples from humans temporarily isolated from the environment by being placed in a special glass cell containing high purity air. Findings indicated that source-type-characteristic features exist in the moderately resolved composition of vapors from humans obtained by gas chromatography which can be used as a basis for detection and identification processes.

5766 APTIC NUMBER 15338

Druett, H. A.
A MOBILE FORM OF THE HENDERSON APPARATUS. J. Hyg., 67(3):437-448, 1969. 8 refs.

A modified version of the Henderson aerosol generator is described. The mobile apparatus can produce bacterial or viral aerosols at 20-95% relative humidity at ambient temperatures. It forms a basic utility for microthread, rotating drum, or other aerosol studies. To operate the generator, the thermostat of its humidifier is adjusted to about 5 C above the ambient temperature, and the heating and spraying units are turned on. About 15 min should be allowed for thermal equilibrium to be established. The apparatus is started having the entry to the spray tube from the suspension spray closed and the water spray in operation. There is a pressure control for spray tube pressure and a proportioning valve to adjust humidity. During normal use, no aerosol escapes from the apparatus. If the apparatus is uncontaminated by microorganisms, the use of chemical disinfectant aerosols advocated by Henderson is not recommended. Diagrams of the apparatus and its components are included.

5767 APTIC NUMBER 14474

Dry, M. E.
THE ROLE OF PROMOTERS IN THE HYDROGENATION OF CARBON MONOXIDE OVER IRON CATALYSTS. (Die Rolle von Prosotoren bei der Hydrierung von Kohlenmonoxyd ueber Eisenkatalysatoren). Text in German. Brennstoff-Chem. (Essen), 50(7):193-196, July 1969. 13 refs.

There are two groups of promoters for iron catalysts: those which enlarge the total surface and those which increase the activity per surface unit. To the first group belong non-reducible metal oxides such as TiO2, Al2O3, Cr2O3, and MgO. They form stable

solutions with magnetite and are stable against thermal sintering. The effect of these metal oxides as surface promoters intensifies with increasing acidity. The other group of promoters is alkaline; the activity of the catalyst per surface unit increases with the alkalinity of the promoter. These promoters also increase the selectivity of the catalyst and reduce the hydrogenation capacity of iron catalysts. On a reduced magnetite catalyst, CO and CO2 are much more readily adsorbed than hydrogen. The alkali oxide supplies electrons to the iron atoms of the catalyst surface and thereby increases the carbon-metal binding capacity of the adsorbed carbon monoxide molecule. Enhancement of this binding makes it easier for hydrogen to attack the carbon-oxygen bond, thus increasing the speed with which intermediate surface complexes are formed. The greater binding strength also prolongs the residence time of the radical on the catalyst surface. As a consequence, hydrocarbon products with higher average molecular weights are obtained. In contrast to iron catalysts, Co and Ni catalysts require no surface promotion by alkalines, due mainly to their resistance to oxidation.

5768 APTIC NUMBER 15236

Dufour, L.
THE ATMOSPHERIC AEROSOL. 117 refs. Translated by Glenn R. Hoidale, Army Electronics Command, White Sands Missile Range, N. M., Atmospheric Sciences Lab., DA TASK 1T061102B53A-18, 87p., March 1969.
AD 685851

The atmospheric aerosol is defined as humid air in which small liquid or solid particles are more or less irregularly dispersed, the largest of these particles being small enough to remain in suspension in the atmosphere for a certain time. The granulometry of Aitken, large, and giant nuclei near the ground and aloft is considered. The fact that the profile of Aitken nuclei in the troposphere is qualitatively the same as that of the large nuclei is taken as proof that the effect of sedimentation is not involved in the establishment of these profiles, since they are independent of the radius of the nuclei. The continents constitute the source of Aitken nuclei, which spread out vertically by turbulent diffusion and horizontally by advection. Formation of the nuclei is discussed in terms of mechanisms resulting from combustion, from chemical reactions, from the release of solid and liquid particles from the earth's surface, and from the entry into the atmosphere of particles of cosmic origin. The chemical composition of the atmospheric aerosol, resistance of the air to movement of the nuclei, terminal fall speed of the nuclei, coagulation of the atmospheric aerosol and atmospheric scavenging by water are also discussed. Junge's equation for calculating the vertical variation of the concentration of the nuclei of a homogeneous aerosol in the vertical plane is developed for Aitken, large, and giant nuclei. It is concluded that such equations should be de-emphasized, since they strongly idealize the natural phenomena and are difficult to use in the absence of accurate data on the value of the coefficients which they contain, especially in regard to the effect of scavenging.

5769 APTIC NUMBER 15439

Dunken, H. and H. Winde
INTERACTIONS BETWEEN SULFUR DIOXIDE AND POLAR COMPOUNDS. II. THERMODYNAMIC PARAMETERS OF COMPLEX-FORMING REACTIONS. (Wechselwirkungen des Schwefeldioxids mit polaren Verbindungen. II. Thermodynamische Groessen der Komplexbildungsreaktionen). Text in German. Z. F. Physik. Chem. Neue Folge (Frankfurt), 58(5/6):246-256, 1968. 8 refs.

The number and stoichiometry of SO2 molecule complexes, as well as the thermodynamic parameters of the respective equilibria, were determined. For this purpose, extinction measurements were taken with the VSU 1 (Carl Zeiss) from -80 C to + 20 C. The complex forming constants were determined from the temperature dependence of the extinction differences of sulfur dioxide in solution with polar compounds in nonpolar solvents (CCl_4; 2,2,4-trimethylpentane; and n-C_8H_{18}. The systems SO2/n-butanol/CCl_4, SO2/isopropanol/CCl_4, SO2/2-butanone/n-C_8H_{18}, SO2/diethylether/n-C_8H_{18}, SO2/n-butanol/2,2,4-trimethylpentane, SO2/acetone/CCl_4, SO2/2-pentanone/n-C_8H_{18} were used. The results show that the enthalpies of the SO2/alcohol complexes are lower by 1 kcal/mol than those of the SO2/ketone complexes. In general, the enthalpies are rather low compared to the enthalpy of a hydrogen bridge. The entropies for the SO2/ketone complexes range from -13 to -15 cal/deg mol. Those of the SO2/isopropanol and n-butanol complexes are much lower. The entropy of the SO2/acetone complex is -12.9 cal/deg mol.

5770 APTIC NUMBER 14987

Edwards, T. H.
ANALYSIS OF INFRARED ABSORPTION SPECTRA OF ASYMMETRIC MOLECULES (FINAL REPORT). Michigan State Univ., East Lansing, Dept. of Physics, Contract AF 19(628)-4009, Proj. 8603-03-01, AFCRL-68-0637, 80p., Dec. 1968. 12 refs.
DDC: AD 682838

Theoretical expressions for centrifugal distortion in planar asymmetric molecules of the type non-linear XYX, and their relationship to more fundamental molecular parameters, are developed. A modified contact transformation was applied to the Hamiltonian to arrive at the form appropriate when there is an accidental near-degeneracy between vibrational states (V1, V2, V3) and (V1-1, V2, V3 plus 1). The revised Hamiltonian was incorporated into computer programs for simultaneous analysis of pairs of infrared absorption bands. Spectra of H_2S, and of several isotopes of H_2Se, and of H_2Te were obtained and analyzed to yield values of numerous molecular parameters for these molecules. (Author abstract modified)

5771 APTIC NUMBER 15235

Richmeier, J.
MOBILITY SPECTROGRAMS OF NATURAL ATMOSPHERIC IONS FOR THE REGION OF SMALL AND MEDIUM-SIZED IONS. Z. Angew. Phys., 23(4):256-260, 1967. 11 refs. Translated from German. Information Gathering

Service, Cambridge, Mass., 10p., July 1968, AFCRL-68-0388. CFSTI: AD 840566

Mobility spectrograms of natural atmospheric ions were made in the laboratory with an aspiration mobility spectrometer consisting of a cylindrical condenser with a single divided electrode and circular ion gas. The spectrograms are reproduced. Within the mobility range 0.05 less than k less than 2 sq cm/Vsec, the mobility spectrum of natural positive and negative ions, as recorded in a closed room, shows a current maximum within the range of small ions which is located at 1.4 sq cm/Vsec for positive ions and 1.8 sq cm/Vsec for anions. Different current maxima cannot be identified in the range of medium-sized ions. The recording of daily changes of the mobility spectrum of positive ions in the same mobility range extended over six days. The mobility spectrogram shows a distinct change over a whole day. The daily changes of the spectral distribution of small and medium-sized ions follow roughly parallel curves. The mobility spectrum of natural positive and negative atmospheric ions in the mobility range 0.003a less than k less than 2 sq cm/Vsec for open windows is shown in a doubly logarithmic graph. The figure indicates that the complete mobility spectrum of natural atmospheric ions consists of only two concentration maxima: a small and narrow maximum in the region of small ions and a wide and high maximum in the region of large ions.

5772 APTIC NUMBER 14397

Plitan, L. and J. P. Morris
SOLID ELECTROLYTE SYSTEM FOR OXYGEN PROPAGATION. Westinghouse Electric Corp., Pittsburgh, Contract NAS-1-7306, NASA-CR-1359, 136p., June 1969. 28 refs.

The main requirements to be met by the reactor were efficient conversion of CO, low catalyst consumption, easy removal of carbon, and production of a gas free of catalyst or carbon particles. The first phase of the investigation covered the selection of a suitable catalyst and the acquisition of data showing the effects on the reaction rate of reactor geometry, temperature, gas composition, and flow rate. The second phase covered the fabrication of a reactor meeting the above requirements and continuous operation of the reactor for a period of 100 days.

5773 APTIC NUMBER 14338

Pasett, Paul R.
THEORY OF GAS SOLID INTERFACE CATALYSIS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 31-52. 49 refs.

The texture and structure of catalysts, theories of catalysis, and fields of catalysis in air pollution work are discussed. The structure, chemical nature, and texture of solid catalysts are determined by use of physical adsorption of gases, BET surface area measurements, influence of pore distribution, and X-ray, electron, and neutron diffraction. These methods may be useful to those who are striving to develop improved catalysts for application to particular phases of air pollution control. Theories of catalysis are chemical, geometric, electronic, crystal field theory, or defect structure. Chemical intuition as to the probable interaction of reactants is important as a guide in catalyst selection and development. The geometric theory represents an early attempt to develop an electronic picture for the vital surface characteristics of catalysts. A certain amount of success was attained in exploring the interrelationship of conductivity and catalytic activity. However, emphasis on the measurement of the ionization potential of the surface of the catalyst and application of crystal field theory to deduce energy states of the surface atoms are receiving increased attention and may be more fruitful than the work on semiconductors. The exact nature of defects causing changes in reaction rates is not known, but results clearly show that defects in general must be considered important to catalytic activity. Catalysts may enter the field of air pollution in instrumentation, actual removal of pollutants, and providing processes that will stop the formation of pollutants. Work done on catalysts to control air pollution centers on the removal of hydrocarbons, carbon monoxide, and nitric oxide from automobile exhaust gases. The elimination of the formation of pollutants involves a catalytic muffler, fuel cells, and nuclear reactors. The extent to which these catalysts will be needed is still uncertain.

5774 APTIC NUMBER 13809

Evans, W. Keith, Sheldon D. Strauss, and Rene J. Bender
PUTTING FUELS TO WORK. Power, 112(6):S26-S37, June 1968.

There are three principal steps in the combustion process: fuel must be prepared for injection into the furnace; fuel and air must be brought together in the correct proportions and at the right temperature for ignition and combustion; and heat produced by combustion must be transferred to the boiler surfaces. To a greater extent than liquid or gaseous fuels, coals range over a wide spectrum of properties. Since the characteristics of coal vary both physically and chemically, two analyses are required to give a true picture of any coal sample. Ultimate analysis shows the fuel's exact chemical composition, without considering the physical form in which various compounds appear. Proximate analysis determines the sample's percentage of moisture, volatile matter, fixed carbon, and ash. Several types of equipment are used in the combustion process including oil burners, stockers, and pulverizers. When dealing with uranium as a fuel for nuclear reactors, the radioactivity of the fission products must be considered. The fuel rods are encased in alloys of zirconium to prevent these products from passing into the general environment.

5775 APTIC NUMBER 13810

Fairbairn, A. R.
THE DISSOCIATION OF CARBON MONOXIDE. Proc. Roy. Soc. (London), Ser. A, vol. 312:207-227, 1969. 23 refs.

The shock tube technique was used to study the infrared absorption of carbon monoxide at temperatures above 5000 K. Radiant emission measurements were made in the infrared, visible, and ultraviolet range. The observed dissociation of CO did not occur directly behind the shock front as expected but followed reactions in the region after the end of incubation time. With increasing temperature and pressure, incubation time becomes shorter, suggesting that incubation is a function of CO concentration. Incubation behavior cannot be explained by the vibration-relaxation process or by vibration-dissociation coupling. The presence of C2 in the dissociation reaction shows that the process is complex and that shuffle reactions may be important. In runs with either neon or argon, the C2 trace always reached its maximum a little later than the end of the incubation time. The initial equilibrium reaction CO plus M yields C plus O plus M is not considered important in CO dissociation. Decay is attributed to the following equilibrium reactions in the region at the end of incubation time: C plus CO yields C2 plus O; O plus CO yields O2 plus C; and C2 plus M yields C plus C plus M. Rate constants, derived from computer analysis of experimental data, are given for each of the four equations.

5775 APTIC NUMBER 10970

Field, Paul E. and James H. Shaffer
THE SOLUBILITIES OF HF AND DF IN MOLTEN FLUORIDES. Oak Ridge National Laboratory, Oak Ridge, Tenn., CONF-660907-1, Rept. ORNL-P-2202, 17p., June 27, 1966. 7 refs.

The solubilities of HF and DF in molten LiF-BeF2 (66-34 mole %) were determined over the temperature range 500-700 C and at solute gas pressures between 1 and 2 atm. Using previously established experimental methods, the solubilities of both gases were found to obey Henry's Law. The Henry's Law constants, K(H) (0.0001 moles HF/mole melt-atm) for HF and DF respectively at 500, 600 and 700 C were approximately 3.37, 2.96, 2.16, 1.83, 1.51, and 1.25. The values given were obtained by a linear least squares fit of the experimental data as in K(H) vs. 1/T and the uncertainties are at the 95% confidence interval. The heat of solution, obtained from the least squares evaluation were approximately 5.98 and -6.43 kcal/mole for HF and DF respectively. The comparison of heat of solution for HF in this melt composition with those obtained previously in melts ranging from 58 to 89 mole % LiF in BeF2 reveals linear dependence of heat of solution on the mole fraction of LiF above and below 67% with a maximum at 67% LiF. Interpretation of the isotope effect is made by comparison of the difference in the entropies of solution between DF and HF with the difference in the calculated values of the entropies of the two gases at 600 C. (Author abstract modified)

5777 APTIC NUMBER 10511

Pinchan, C. J. B. and F. D. Richardson
THE BEHAVIOUR OF SULPHUR IN SILICATE AND ALUMINATE MELTS. Proc. Roy. Soc. (London), Ser. A, 223(1152):40-62, 1954. 39 refs.

A study was made of sulfur in liquid silicates and aluminates. Mixtures of CaO-SiO2, MgO-SiO2, FeO-SiO2, CaO-Al2O3, and CaO-SiO2-Al2O3 were brought into equilibrium between 1350 and 1650 C with gas phases made by mixing H2, CO2, and SO2 at room temperature. It was shown that when the pressure of O2 is less than 1.00001 atm, a sulfur atom can only enter the melt by displacing oxygen atoms. The sulfur is held in the slag entirely as sulfide. When the pressure of O2 is greater than 0.001 atm, the sulfur is held as sulfate. In the binary silicate melts, there must be three kinds of oxygen atoms present; those bonded to two silicon atoms, those bonded to one silicon, and those unattached to silicon. From the manner in which both the sulfide and sulfate equilibria depend upon the proportions of metal oxide present, it appeared that only the oxygen atoms unattached to silicon are of importance. The potential capacity of a melt to hold sulfur as sulfide is expressed as its sulfide capacity. For binary silicate and aluminate melts, there is a close parallelism between the value of this capacity and the activity of the basic metal oxide. The activity coefficients for CaS and CaSO4 were the same and were constant in CaO-SiO2 mixtures. The sulfide equilibrium results were used to improve the free energy of formation curve for the formation of CaO-SiO2 melts and to construct a similar curve for CaO-Al2O3 melts. The sulfur capacities of the ternary melts, CaO-SiO2-Al2O3, were shown to be a maximum at compositions for which the molar proportions of SiO2 and Al2O3 are equal. This behavior is expected, because the energy of interaction of SiO2 and Al2O3 is greater than that of CaO-SiO2 or CaO-Al2O3. It follows the previously established pattern. (Author abstract modified)

5778 APTIC NUMBER 10659

Fischer, Siegfried
THE T,S/P- AND T,S/P DIAGRAM FOR IDEAL GASES. (Das T, S/P- und i,S/P-Diagramm fuer ideale Gase). Text in German. Wiss. Z. Tech. Univ. Dresden, 15(4):713-719, 1966. 9 refs.

A T,S/P (T equal temperature, S equal specific entropy, P equal universal gas constant) and i,S/P (i equal enthalpy) diagram is described which permits the plotting of several ideal gases or gas mixtures in one diagram. The dependence of the specific heat on the temperature is expressed by a correction curve. The T,S/P and i,S/P diagram for air and flue gas is used to demonstrate the feasibility of representing any arbitrary gas mixture by linear interpolation between the correction curves. Thus, the entire combustion process of a combustion engine can be represented by one diagram no matter what fuel to air ratio exists. Even very complicated processes, such as those of a turbine with water injection, can be aptly represented by the diagram. The only limit to the accuracy is the scale of the diagram.

5779 APTIC NUMBER 10852

Fletcher, R. and S. J. Leach
THEORETICAL STUDY OF LONGITUDINAL DIFFUSION INTO A ONE-

DIMENSIONAL TURBULENT FLOW, OF MATTER FROM A SOURCE MOVING AT THE FLOW VELOCITY. Ministry of Power, Sheffield, England, Safety in Mines Research Establishment, RR 251, 8p., 1967. 3 refs.
CPSTI, PB 183 762

This paper investigates the dispersion of soluble matter into a turbulent stream in a pipe, the matter being emitted continuously by a source traveling with the mean velocity of the stream. The matter leaves the region of the source mainly by the variation of velocity across the pipe and by turbulent diffusion, but it also leaves by bulk flow, due to the volume input of matter. The combined effects of velocity variation and turbulent diffusion are described by a virtual coefficient of diffusion relative to axes moving with the source. Complete mixing over the pipe is assumed. By considering the rate of mass flow across a section of the pipe, a diffusion equation was formed, which gives the mean concentration over a cross-section as a function of position, time of emission, concentration in the source and the virtual coefficient of diffusion which depends on the pipe roughness. A possible application is to the build-up of toxic gases around a diesel locomotive moving along a mine roadway in the direction of the ventilation at about the velocity of the ventilating air. (Author introduction modified)

5780 APTIC NUMBER 15781

Flood, H. and O. J. Kleppa
INVESTIGATIONS ON THE POLYMORPHIA IN THE SYSTEM V2O4, V2O5, VOSO4, SO2, SO3. J. Am. Chem. Soc., vol. 69:998-1002, May 1947. 12 refs.

When two solid phases are present, the system vanadium tetroxide, vanadium pentoxide, vanadium persulfate, sulfur dioxide, and sulfur trioxide provides one univariant and two bivariant equilibria. All three equilibria were measured by passing a current of SO2 through a plug comprising mixtures of V2O4-VOSO4, V2O5-VOSO4, or V2O4-V2O5. After passing the contact, the content of SO3 was determined and the corresponding equilibrium constants were calculated. The composition of the solid phases was controlled by chemical analysis. The phases were identified and the modifications controlled by powder diagrams. It was found that V2O4 formed by V2O4 reduction below 615 deg is not the well-known tetragonal modification (rutile-lattice), but the previously unreported modification VOSO4. The amounts of the tetragonal modification obtained increased with increased temperature. The stability of the new modification could not be determined. A complete transition to the rutile type lattice was easily attained by heating for a short period at 800 deg. However, when heated for 14 days at 605 deg, neither modification showed definite signs of change. Equations are given which reproduce the experimental results with good approximation.

5781 APTIC NUMBER 14911

Flood, Hakon
SOME ASPECTS OF THE CONNECTION BETWEEN THE STRUCTURE AND THE ACTIVITIES OF THE COMPONENTS IN MOLTEN SALT MIXTURES. Svensk. Kem. Tidskr., 68(10):509-520, 1956. 12 refs.

The Temkin model of salt melts assumes that in molten salts, cations are surrounded only by anions and anions only by cations. In a mixture of several salts, the cations are randomly mixed with each other, as are the anions. The molten salt mixture can be considered as two coexisting solutions, one cationic and one anionic. Formulae are derived to show that the Temkin model is valid for mixtures deviating from ideality, i.e., binary mixtures with one common anion (or cation) and salt mixtures without common ions. The expressions were first tested by application to a well-known metallurgical equilibrium equation based on the variation of the activity of iron oxide with the composition of slag. When the values obtained by use of the equation were compared with the oxygen content of iron in equilibrium with slag containing Fe, Ca, Mg, SiO4, and O, relatively good agreement was found to exist between theoretical and experimental values. Activity coefficients were then calculated for components of the two systems Na-K-F-Cl and Li-K-F-C. Although the approximate formula showed deviations from ideality for components with higher lattice energies, good agreement was obtained in the case of components with lower lattice energies. As predicted theoretically, miscibility of the first system was complete. The Temkin theory, however, does not explain the activity of a MgCl2-NaCl melt structure, which appears to form a transition between a simple ionic and complex model. In such systems, more complicated treatment is required to describe the variation of activity with composition of the melt.

5782 APTIC NUMBER 14563

Flood, H. and T. Forland
SOME INVESTIGATIONS ON THE OXYGEN-OVERPOTENTIAL IN MOLTEN SALTS. Faraday Soc. Discussions, 1(1):302-307, 1947. 4 refs.

The use of oxygen electrodes to measure oxide ion activities was investigated. The oxygen overpotentials in melts of Li-Na sulfate, and of sulfate, carbonate, phosphate, and silicate dissolved in Na-Li fluorides showed some common characteristics. At low current densities (c.d.) and high temperatures, the temperature coefficient of the overpotential is low as is the variation with c.d. At high c.d. and low temperature, the temperature coefficient and the variation with the c.d. are distinctly higher. The overpotential in this region, which seems to be of an activated nature, decreases in the order SO4(2-), PO4(3-), CO3(2-) SiO4(4-); i.e., parallel with the bond strength of the X-O bond (X equal to S, P, C, Si). The lower overpotential of solutions of sulfate in fluoride appear to depend on an expansion of the non-activated section. In melts of Na carbonate and of alkali oxides dissolved in Na-Li fluoride, the overpotentials at high temperature and low c.d. show a linear variation with c.d. The characteristic feature of these systems is their high basicity. This perhaps indicates the possible formation of surface oxides which would give rise to the observed potential effect.

5783 APTIC NUMBER 15023

Flynn, G. W., M. A. Kovacs, C. K. Rhodes, and A. Javan
VIBRATIONAL AND ROTATIONAL STUDIES USING Q SWITCHING OF MOLECULAR GAS LASERS. Appl. Phys. Letters, 8(3):63-65, Feb. 1, 1966. 5 refs.

Vibrational and rotational relaxations in the CO2 and N2O laser systems were studied by Q-switching techniques. It is shown that during the time in which Q-switching takes place, thermalization of the rotational levels can be prevented. Thermalization in the presence of laser oscillation leads to a coupling between various rotational levels and, consequently, a decrease in the number of oscillating laser transitions. At low pressures, where thermalization rates are slow, the populations of various rotational bands are entirely decoupled during the Q-switched pulse and various rotational transitions oscillate independently. At elevated pressures thermalization occurs even during Q-switching time. The presence of a nonthermal population distribution within the rotational levels is an important consequence of the lack of thermalization during the Q-switch period. This implies the presence of sizeable population inversion within the levels during the Q-switch period.

5784 APTIC NUMBER 15040

Prejacques, C., O. Bilous, J. Dizmier, D. Massignon, and P. Plurien
PRINCIPAL RESULTS OBTAINED IN FRANCE IN STUDIES OF THE SEPARATION OF THE URANIUM ISOTOPES BY GASEOUS DIFFUSION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 8:418-421. 8 refs.

Experience and results covering a range of problems in the gaseous diffusion separation of uranium isotopes are summarized. In studying porous barriers prepared by the agglomeration or fritting of submicronic grains, it was found that a marked improvement in their resistance to corrosion by uranium hexafluoride (UF6) can be obtained by preliminary treatment with F2 or, still better, with ClF3. For the treatment of impoverished or slightly enriched UF6 a simple method leading to UF4, of reduring preheated UF6 by hydrogen in a torch, was developed. In this method, the reaction is maintained by its exothermal character; the yield of UF4 relative to the UF6 is greater than 99%. The determination of hydrofluoric acid in UF6 is performed with gaseous UF6 by infrared absorption spectroscopy. An experimental apparatus for testing tolerance of plant construction materials to corrosion by UF6 permits the selection of certain metals and alloys, including nickel, aluminums, and some stainless steels, and determination of the conditions under which they must be preheated. Efforts to achieve maximum tightness in the gaseous diffusion apparatus are noted. A prototype mass spectrometer developed for isotopic analysis of U235 and U238, as well as for general use, is described. Consideration is also given to the chemical engineering factors and decisions involved in designing a gaseous diffusion plant.

5785 APTIC NUMBER 13811

Prey, D. J.
DE-ASHED COAL COMBUSTION STUDY. Dept. of Interior, Washington, D. C., Office of Coal Research, Contract 14-01-0001-417, 25p., Oct. 5, 1968

Evaluation of the burning characteristics of low-ash coal containing 59.2% volatile matter, 40.6% fixed C, and 0.15% ash was carried out by firing in existing test equipment in both its solid and liquid states, using commercially acceptable procedures for firing heavy oils and pulverized coals. The base coal was dissolved in a solvent, filtered to recover most of the ash, and then heated to recover a portion of the solvent. The physical properties of the de-ashed coal could be altered by adjusting the amount of solvent left in the coal. The coal was pulverized to a fineness in the range of 70-75% through 200 mesh and fed into the test furnace (preheated to 1600-1800 F) at the rate of 133 lb/hr, along with about 70,000 btu/hr of igniter gas. Test duration was 50 min, total heat input was 2,070,000 btu/hr, with an excess air of 18-20%. It was concluded that the combustion characteristics of the de-ashed coal was essentially the same as those of high or medium volatile bituminous coals. Based on the packing characteristics observed, it is suggested that storage of pulverized coals should be avoided and that plugging and packing problems should be anticipated in systems utilizing this fuel. Results of the liquid state studies indicated that problems would be limited to handling and control techniques. It is recommended that heating should be carried out under pressure in a closed system, all equipment contacting the coal be heated to over 350 F, and steam-atorizing oil guns be used to eliminate the need to heat gun components. Provisions must be made to purge all lines and valves of liquid coal for extended shutdowns.

5786 APTIC NUMBER 15702

Freysz, E., P. Rieth, C. Judes, M. Sensenbrenner, M. Jacob, and P. Mandel
QUANTITATIVE DISTRIBUTION OF PHOSPHOLIPIDS IN NEURONS AND GLIAL CELLS ISOLATED FROM THE CEREBRAL CORTEX OF ADULT RATS. (Distribution quantitative des divers phospholipides dans les neurones et les cellules gliales isoles du cortex cerebral de rat adulte.) Translated from French. J. Neurochem., 15:307-313, 1968. 32 refs.

A method was devised for the isolation of neurons and glial cells which make it possible to gather sufficient material for the identification and study of the metabolism of the various phospholipids in the adult cells and in the course of their maturation. The authors set forth the results obtained on cells isolated from the cerebral cortex of the adult rat. Their tests were made on Wistar rats. The cerebral hemispheres are taken out and immediately placed into a 9/1000 sodium chloride solution. All operations were performed at a temperature between 0 degrees and 4 degrees. After the cortex was cleaned of white matter and meninges, it was cut into small fragments and placed in suspension in 8 ml of a glycerol-acetone-water mixture (1:1:1) 30 minutes. The suspension was then centrifuged, and the mass was forced through a nylon sieve with a 82 micron mesh opening, into a 0.25M (3:1) glycerol-sucrose mixture. To ascertain the number of cells, the cellular mass was re-homogenized in a 9/1000 sodium chloride

solution. An aliquot part was dyed with methylene blue and the counting was performed by means of a Thoma chamber. The remainder of the suspension was then centrifuged and the resulting mass was lyophilized. It appears from these experiments that glial cells and neurons contain the same types of phospholipids as the total brain, but the absolute amounts are always higher at the level of the glial cell for all the phosphatides studied. This can be he explained by the presence of more abundant membranous formations at the level of the glial cells. It should be noted that the amount of each phosphatide with respect to the total lipid P is similar in the two types of cells. This suggests an analogy of of the membranous structures in these two cell types, at least as regards the phospholipids. One may therefore speak of a similar "phospholipid membranous model" in the various types of cells of the central nervous system, without it being identical.

5787 APTIC NUMBER 15375

Fritsch, W. Hans
RESONANCE PHENOMENA IN FLUE STACKS. V. (Resonanzerscheinungen an Schornsteinen. V). Text in German. Oel Gasfeuerung, 14(1):20-37, 1969.

The trend of ever narrower flue stacks has focused attention on resonance phenomena in the boiler-flue stack system. The basic physical concepts of oscillations, damping, and resonance and their mathematical descriptions are reviewed. While the flue stack alone has one resonance frequency, the boiler plus flue stack system has two or more. The flame in the boiler depends on the ambient pressure and follows the oscillations with an in-phase and a quadrature component. The flame is able to maintain steady state oscillations if the damping constant of the flameless system is equal to (m/2)/(282,000/Q) - n, where Q in kcal/cu m/hr is the energy density of the boiler furnace and m and n are the experimentally determined relative values of the in-phase and the quadrature flame fluctuations. Model experiments using 2 to 4-long tubes with 100 mm diameter and audioacoustic measurement equipment are described. In this model, typical pressure amplitudes of 20 mm water and resonance frequencies up to 200 Hz were measured. For different geometries, a dimensionless parameter, BT, which allows extrapolation to all stack dimensions can be determined. The concept of the phase diagram of an oscillator is discussed. A numerical example with oscillograph photographs illustrate the usefulness of model measurements.

5788 APTIC NUMBER 18575

Gaskill, J. R. and D. J. Hodgkins
FURTHER STUDIES ON OPACITY AND COMPOSITION OF SMOKES FROM SMOLDERING AND BURNING MATERIALS. In: Hazards Control Progress Report No. 33 (Jan.-April 1969), California Univ., Livermore, Lawrence Radiation Lab., UCRL-50007-69-1, p. 47-59.

A study was made of the opacity of smoke from wood treated with specific fire retardants and some foamed urethanes, comparison of smoke opacity using a smoke chamber, and the use of specific optical density as a means of determining visibility through smoke in practical fire situations. Under nonflaming exposure, the fire retardants reduced maximum smoke density. Under flaming exposure, these fire retardants increased smoke density. Nonflaming rigid urethane foams yielded dense or very dense smokes; under flaming exposure, the smokes were denser and obscuration was faster. Ventilation reduced the smoke densities of the nonflaming foams in a manner similar to those of woods, but had less noticeable effect on the flaming materials. The flexible urethane foams showed similar characteristics, but with certain peculiarities. Two of the four flexible urethane foams yielded smoldering smokes which gradually increased to a high density. The other two smoked faster but to a lower density. Under flaming conditions, two materials smoked as densely as their nonflaming counterparts, and the other two yielded smokes of lower densities. Ventilation affected the smoke densities of the flexible foams less than those of the rigid foams with two exceptions. In one case, the smoke remained quite dense; in the other the smoke was light. Components found in smokes of urethane foams showed a slight decrease in oxygen under flaming conditions. Carbon monoxide was found in all smokes from flaming foams but in varying amounts. The high-temperature variety of foam showed the highest amount of HCN in its smokes. Inspection of specific optical densities of 50 and 100 showed that visibility through the smokes is probable only in those cases where small areas are emitting smokes into very large compartments.

5789 APTIC NUMBER 18749

Glushkov, Yu. M.
COMPARISON OF FIBROUS FILTERS IN FREE-MOLECULAR FLOW. (Sopotivlenive voloknistykh fil''cov v svobodno-molekulyarnom potoke). Text in Russian. Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza, no. 4:176-181, July-August, 1968. 3 refs.

The flow of gas through an anisotronic porous medium formed by partially ordered fibers was examined. In such a medium, the mean free path and the average scattering cosine depend upon the direction of the molecule velocity vector. An infinite system of randomly intervoven fibers with axis perpendicular to the mass velocity of the gas was taken as a model for fiber filters. Fibers with circular, arbitrarily bulging, and dumbbell shapes were considered. Results of calculation are compared with experimental data obtained with absorption filters and fiberglass filters. Deviation between experimental and calculated values for a coefficient defined as the change in probability density for encounter of a molecule with the filter divided by this probability density times the gas flow rate through the filter reached a maximum of about 8%.

5790 APTIC NUMBER 18509

Gottanf, W.
GAS-CHROMATOGRAPHIC DETERMINATION OF ORGANIC COMPOUNDS IN AIR IN PRESENCE OF OZONE. (Gas-chromatographische Bestimmung organischer Verbindungen in Luft bei Anwesenheit von Ozon). Text in German. Anal. Chem., 246(1):31, 1969. 2 refs.

Trace analyses of organic compounds in air can be successfully performed by using a gas chromatographic method. The air

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sample is passed through a cold trap which causes the organic compounds to condense. The carrier gas then takes them through the chromatographic column. In the presence of ozone, the ozone is also condensed, at least in part, in the cold trap and begins to react with certain organic compounds either immediately or during the heating process. Many organic substances are thus destroyed and cannot be analyzed. This result can be avoided by adding an excess amount of ethylene to remove the ozone. This method was successfully used for measurements of the reaction rate between ozone and various gaseous odorants. It was possible to determine hexanal, 2-hexenal limonenes, allylisothiocyanate, and pyridine in concentrations of 10 to the minus eighth power moles/l at ozone concentrations between 10 to the minus seven and 10 to the minus five moles/l.

5791 APTIC NUMBER 15414

Gouheau, Josef, Hans Kolb, and Hans Guenther Krall
THE SYSTEM POTASSIUM SULFATE - POTASSIUM SULFIDE. (Das System Kaliumsulfat-Kaliumsulfid). Text in German. Z. Anorg. Allgem. Chem., 238(1):45-56, 1938. 2 refs.

For a study of the system potassium sulfate-potassium sulfide the latter substance was produced according to the Hugo-method by reaction of potassium and sulfur in liquid ammonia. A detailed description of this reaction process is given. The potassium sulfide obtained by this method is a yellowish, loose powder which burns up within seconds when exposed to air. For thermal studies, nitrogen to which one fourth of its volume of hydrogen was added was used as protective gas. The two salts were intensely mixed and heated. Upon termination of this process, the cooling curve was established through temperature readings in intervals of 10 seconds. The melting point of the potassium sulfate was found to be 1067 C. The crystallization points decreased steadily to a eutectic at 56% by weight of potassium sulfide and a temperature of 587 C. No halting points were found for the eutectic. It was concluded that mixed crystals had formed. From the critical points of the eutectic at higher potassium concentrations it was concluded that the sulfide content of the saturated mixed crystals was 30% by weight. From the eutectic the liquidus/solidus line rises to a maximum at about 66% by weight of potassium sulfide corresponding to a compound K_2SO_4-$3K_2S$ whose melting point is just a few degrees above 755 C. This compound forms with 72.5% of potassium sulfide a eutectic with a melting point at 730 C. The melting point of pure potassium sulfide was found to be 912 C. For confirmation of these findings, additional radiographic (Debye-Scherrer method) studies were performed and the lattice parameters for pure potassium sulfate and for melt with 22% by weight of potassium sulfide were computed. The formation of mixed crystals between the two substances could be confirmed. The radiograph of the compound K_2SO_4-$3K_2S$ indicated a cubic lattice structure and yielded a lattice constant of 9.22 angstrom.

5792 APTIC NUMBER 10971

Grafton, Raymond William
PROCESS FOR THE TREATMENT OF GLAUBER'S SALT. (Courtaulds Ltd., London) Brit. Pat. 801,527. 9p., Sept. 17, 1958. (Appl. Jan. 28, 1957, 6 claims).

A process is claimed relating to the treatment of Glauber's salt, large quantities of which are obtained as a by-product in the viscose rayon industry, in order to permit the recovery of useful chemicals from the salt. To date, this salt has had little market value. The process comprises dissolving the salt in water, treating the solution with an ion-exchange resin to form sulfuric acid and a sodium resin salt, and regenerating the sodium resin salt by treatment with nitric acid. The reactions involved in this process are RH + Na_2SO_4 yields RNa_2 + $1/2H_2SO_4$, and RNa_2 + HNO_3 yields RH + $NaNO_3$, R being the cation exchange resin. The process is preferably effected in a cyclic manner. The recovered solutions are sulfuric acid, which can be used directly in the viscose rayon factory, and sodium nitrate, which can be used as a fertilizer. In one cyclic process of this invention, the ion-exchange resin is contained in a number of reactors which are arranged on a turntable, which moves the reactors in a cyclic manner so that each reactor moves in turn through four fixed zones. In another cyclic process, the reactors, instead of being arranged on a turntable, are fixed, and a single rotary valve is provided which connects the various reactors to the correct liquor feeding and withdrawal points at the appropriate stages in the cyclic process. The number of reactors in the various zones is determined by the particular reaction to be carried out and the degree of conversion required, but in general from two to five reactors in each zone seems to be sufficient for economic operation. In addition, the speed of rotation of the turntable or rotary valve and the rate of feed of the solutions supplied to the reactors must be suitably correlated to allow for adequate reaction times. Technical details of the process, a sample experimental apparatus, and pertinent diagrams are included.

5793 APTIC NUMBER 13766

Graham, T. Lyon
THE ABSORPTION OF SOLUTION OF METHANE AND OTHER GASES IN COAL, CHARCOAL, AND OTHER MATERIALS. Colliery Guardian (London), 122(3168):809-811, Sept. 16, 1921. 7 refs.

The absorption curve for coal dust and CO2, up to a 50% concentration, was first obtained by making several additions of known quantities of the gas and reading the equilibrium pressure. A definite amount of methane was then added and allowed to set for two days, to ensure equilibrium between the CO2 and methane in the gas mixture and that adsorbed by the coal. The points obtained for the adsorption of CO2 alone, and mixed with methane lay practically on the same curve when allowance was made for experimental error. There was, however, a marked effect on the adsorption of methane. A much smaller amount was adsorbed by the coal when CO2 was present than when only methane was present. It was found that when moisture was added to the coal dust, its adsorptive capacity decreased by 25%, and when 10.5% pyridine was added, the adsorptive capacity was reduced to a lower level. Crushing the coal in the laboratory did not produce an increase in the coal adsorption proportionate to the increase in surface area. It was concluded that the actual surface area of the

particle forms only a small proportion of the total surface available for adsorption. Coal dust was examined for use in Army respirators during 1917-1918. It was found that while it was very effective for adsorbing chlorine gas, it was useless for the adsorption of carbon monoxide.

5794 APTIC NUMBER 18585

Grahame, D. C., M. A. Poth, and J. T. Cummings
THE DIFFERENTIAL CAPACITY OF THE ELECTRICAL DOUBLE LAYER. THE ROLE OF THE ANION. J. Am. Chem. Soc., 74(17):4422-4425, Sept. 5, 1952. 13 refs.

A systematic study of the influence of the anion upon the capacity of the electrical double layer at a mercury-solution interface was determined for twelve solutions of tenth-normal potassium salts. The results show that there is a strong correlation between the shape of the capacity curves and the solubilities of the corresponding mercurous salts. Anion pairs which exhibit the same general solubility relationships (nitrate-perchlorate, carbonate-hydroxide) also exhibit similar capacity curves. The large capacity arises, not from the fact of the existence of large metal-to-ion forces, but from the fact that the magnitude of these forces vary with potential. In general, it seems evident that the composite of properties which determines general solubility relationships also determines the form of the capacity curves. The surface charge density was obtained by numerical integration of the capacity curves. It was concluded that it is possible to find by electrical measurements alone not only the shape of the electrocapillary curve but also the height of one curve relative to another. This enables one to ascertain by electrical measurements, the concentrations of cations or anions in the double layer.

5795 APTIC NUMBER 15226

Grandillo, R. D.
A STATISTICAL EVALUATION OF POWDER CHARACTERISTICS MEASURED WITH THREE SYSTEMS. Mound Lab., Miamisburg, Ohio, Contract AT-33-1-GEN-53, 27p., Feb. 28, 1969. 1 ref.
CESTI: MLM-1580

Particle sizes of powder samples were statistically analyzed using data from three systems, a Coulter Counter, a sedimentation balance (Sedibal), and a Fisher Sub-Sieve Sizer. It was concluded that the particle size distributions obtained from the Coulter Counter and Sedibal are log normal. It was also concluded that the weight fraction distribution is not a probability distribution, but is a weight fraction-in diameter relationship, which is functionally related to the probability function defining the number-fraction data. A statistical model was derived which showed that the average specific surface is a function of the parameters of the number fraction distribution. (Author abstract)

5796 APTIC NUMBER 15663

Gravelle, P. C., C. Marty, G. Elshobaky, and S. J. Teichner
ADSORPTION OF CARBON MONOXIDE ON NICKEL OXIDE. (Adsorption de l'oxyde de carbone sur l'oxyde de l'oxyde de carbone sur l'oxyde de nickel). Text in French. Bull. Soc. Chim. France, no. 5:1517-1524, 1969. 1 ref.

The adsorption of carbon monoxide was studied, principally by microcalorimetry, on specimens of pure nickel oxide prepared by dehydration of nickel hydroxide in vacuo at different temperatures between 200 and 300 C, as well as on specimens of nickel oxide containing foreign ions such as Li(+) and Ga(3+). At 30 C, the most active surface sites are formed by the adsorbed oxygen ions or by the excess anions, in very small numbers on a quasi-stoichiometric oxide. The adsorption of carbon monoxide leads to the formation of carbon dioxide. Interactions also take place between carbon monoxide and the surface anions, in particular, those located in the neighborhood of cation holes, but without leading to a formation of carbon dioxide. Carbon monoxide also attaches itself at 30 C in a reversible or irreversible manner to the surface cations. Every modification of the surface structure of the solid, resulting either from the incorporation of foreign ions or from a different temperature of sample preparation, has an influence on the affinity of nickel oxide for carbon monoxide at 30 C and on the distribution of different types of surface sites. When the temperature is increased beyond 70 C, the adsorption on cations decreases, while the reaction between carbon monoxide and the surface ions leading to the formation of carbon dioxide becomes progressively more predominant.

5797 APTIC NUMBER 15079

Groth, W. E., E. Beverle, P. Mann, and K. H. Welge
ENRICHMENT OF THE URANIUM ISOTOPES BY THE GASCENTRIFUGE METHOD. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, Vol. 4:439-446. 7 refs.

Progress in developing the gas centrifuge method of isotope enrichment is reported. A detailed description of the structure of the ZG 3 gas centrifuge is given, with diagrams and operating data. The most important improvements are: the high elasticity of the tubular shafts for the gas leads; the greater lifetime and reduced sensitivity of the damping bearings; reduction of the oil distribution system by using oil of the same gas content at all points; reduction of the power consumption of the oil supply and of the oil pressure in the high-pressure circuit; reduction of the space required for assembling and dismantling the unit; regulation of the rotor temperature by eddy-current heating and the measurement of the temperature differences between the rotor covers; and the increase of the peripheral velocity, by the use of titanium as rotor material, and of the rotor length, demanding supercritical speeds of rotation. Experiments with the ZG 3, carried out with rotors of 66.8-cm inner length and 18.5-cm inner diameter, and using xenon as the substance for analysis, are described. Only 33.5% of the theoretical maximum separation potential was attained; possible reasons for this small value are discussed briefly.

5798 APTIC NUMBER 15195

Grove, G. R., K. W. Foster, and R. E. Vallee
PARAMETERS OF THERMAL DIFFUSION COLUMNS. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. O. C. Nier (eds.), New York, Interscience, 1958, Chapt. 35, p. 862-870. 7 refs.

The separation of mixtures of hydrogen and deuterium and hydrogen and helium was studied in experimental thermal diffusion columns having coaxial molybdenum center wires operated at temperatures up to 1050 K. Cold wall temperature was maintained at about 295 K. Separation factors were measured as a function of gas pressure, flow rates, separation time, ratio of column to wire radii, and center wire temperature. Effective thermal diffusion separation per unit length of column were essentially constant over the length of the column. Characteristic curves were obtained of equilibrium separation values as a function of initial column pressure with no draw-off. Maximum values of the profile curves corresponded to conditions in which convection and diffusion remixing coefficients are equal and proportional to convection shape factor. The time required to reach essentially equilibrium separation varied from about three hrs for a wire temperature of 280 C to about 1 1/2 hrs for a wire temperature of 850 C. There was a corresponding decrease in initial column pressure for maximum separation. In the higher temperature range, optimum column pressure was essentially temperature-independent. The effective values of the transport, convection, and diffusion shape factors were found to be significantly different from those of a Maxwellian gas. Therefore, the cylindrical corrections calculated for a Maxwellian gas cannot be applied to the separation of the isotopes of nonMaxwellian gases by thermal diffusion.

5799 APTIC NUMBER 13727

Gubcova, Alzbeta, Gabriel Cerny, and Frantisek Sehnalek
COMPUTING ANALYSIS OF CO-CO2-SO2 ATMOSPHERES. (Vypocet zlozenia atmosfery CO-CO2-SO2). Text in Czech. Hutnicke Listy, 24(7): 525-529, 1969. 8 refs.

Experimental thermodynamic equilibria between condensed and gaseous phases at high temperatures are considered with particular reference to the equilibrium between phases of the Fe-S-O system and a CO-CO2-SO2 atmosphere at 1200 C. In contrast to the H2-H2S-H2O and N2-S2-SO2 atmospheres, the CO-CO2-SO2 atmosphere involves a wide range of equilibrium partial pressures of S and O of the Fe-S-O system. Due to the large number of constituents, namely, SO, SO3, CS, CS2, COS, S, S2, S4, S6, S8, and O2 present in the C-O-S system at 1200 C, computation of the input composition of the CO-CO2-SO2 gas mixture at which the equilibrium partial pressures p(S2) and p(O2) at 1200 C have prescribed values is difficult. By means of a new mathematical approach and the CDMA-1013 computer, the required composition of the CO-CO2-SO2 gas mixture was determined in detail for given values of p(S2) and p(O2) at 1200 C from 0.000001 to 0.39 and from 10 to the minus 13th power to 10 to the minus 8th power atm, respectively. The results are tabulated and plotted as p(S2) and p(O2) isobars in a CO-CO2-SO2 composition diagram.

5800 APTIC NUMBER 14986

Guentheroth, Hans
AN ARTIFICIALLY GENERATED AEROSOL FOR WET SCRUBBER TESTS ON A SEMI-INDUSTRIAL SCALE. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):82-87, Nov. 1968. 11 refs.
CFSTI: TT 68-50888/11

An aerosol generator is described which produces an aerosol satisfying the following requirements: particle size about 0.1 to 1 micron, solid and hydrophobe particles, low electric charge, practically no agglomeration, suitable for investigation under the electron microscope, and production rate 500 g/hr. Reproducible results were obtained with a generated aerosol in a Venturi scrubber; they proved that the water/gas ratio and flow kinetics have the most important influence on dust removal efficiency. The earlier theory that only air losses are of decisive importance was disproved. The wettability of aerosol particles in this size range appears to be of secondary importance provided that the dust can be brought to the surface of the liquid. A testing program is described for explaining the influence of wettability within the particle size range of 0.1 to 1 micron in the case of industrial methods of wet dust removal. (Author summary modified)

5801 APTIC NUMBER 14985

Gurvich, A. S.
THE DETERMINATION OF TURBULENCE CHARACTERISTICS FROM LIGHT SCATTERING EXPERIMENTS. Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz. Atmosfer. i Okeana), 4(2):160-169, Feb. 1968. 18 refs.

Fluctuations generated in a light wave during its propagation in a statistically inhomogeneous medium can provide information on the type of inhomogeneities involved. When the relative fluctuations of the refractive index are small and its changes at distances of the order of the wavelength are likewise slight, the pulsation spectra of the refractive index of a medium can be determined from the fluctuation spectra of the wave's intensity and phase. An experiment in which intensity fluctuations are measured appears to be the simplest method of approach. Calculations performed for the high-frequency part of the intensity-fluctuation spectrum indicate that the method is sufficiently sensitive to make possible the investigation of small-scale inhomogeneities in the atmospheric temperature field. (Author abstract modified)

5802 APTIC NUMBER 15047

Gverdtsiteli, I. G., R. V. Kucherov, and V. K. Tskhakaya
ISOTOPE SEPARATION BY DIFFUSION IN A CURRENT OF STEAM. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 8:608-618. 8 refs. (Translated from Russian).

Experimental and theoretical investigations of the separation of isotopes by diffusion in a current of auxiliary vapor is described. A study was made of the apparatus based on the elementary effect and its use in separating columns. Theoretical calculations made it possible to find the principal parameters of the process on the basis of constructional characteristics of the apparatus and on the basis of experimentally measured values. The membrane used in the process serves only for creating hydrodynamical currents in the necessary direction and is, therefore, a loose porous barrier with pores whose average diameter considerably exceeds the length of the free path of molecules. It was concluded that the method of diffusion in a vapor current can be used for separating the isotopes of a number of gases. The small gas requirement of the installations allows the separation of small amounts of a substance. Separating installations are simple in construction and convenient in operation. The process can be easily made automatic. Given the comparatively high separation factor, and the short time required for establishing the stationary conditions of operation, the method was recommended for obtaining highly concentrated isotopes under laboratory conditions.

5803 APTIC NUMBER 18867

Haenel, Gottfried
OBSERVATIONS ON THE THEORY OF JET IMPACTORS. (Bemerkungen zur Theorie der Duesen-impaktoren). Text in German. Atmos. Environ., 3(1):69-83, 1969. 15 refs.

The familiar theory of jet impactors is valid only for spherical particles at low Reynolds numbers. Exact application of this theory to non-spherical particles in jet impactors is not possible. Therefore, the impactor theory was modified and is now based on the equation of motion of non-spherical particles at conditions occurring in jet impactors. Aerodynamic drag coefficients and form factors of a number of particle shapes are discussed. These factors, together with their variation with Reynold's and Mach's numbers, are contained in a special inertia coefficient. It is shown how the collection efficiencies of impactors are calculated from the solution of the equation of motion of particles. It is possible now to explain the differences between the impactor calibrations of Ranz and Wong and of Stern et al. Calculations on the influence of particle shape and density on the impaction process show that jet impactors and other sampling instruments based upon the inertia principle are not capable of measuring the size and the number of atmospheric aerosol particles in absolute terms.

5804 APTIC NUMBER 15317

Hagopian, Trivan
INSTRUMENT FOR DETERMINING OZONE. (Cabot Corp., Boston, Mass.) U. S. Pat. 3,464,797. 3p., Sept. 2, 1969. 2 refs. (Appl. Oct. 26, 1966, 5 claims).

A process for measuring the quantity of ozone in multicomponent gas streams entails catalytically decomposing ozone to oxygen, dissipating the heat of the reaction, and measuring a difference in thermal conductivities. The apparatus in which the process is carried out provides for the separation of the ozone-bearing gas into two substreams. One stream flows directly to the first of two thermal conductivity cells, while the other flows through a bed of activated charcoal on which decomposition occurs before it is carried to the second cell. Since equilibrium is maintained by a simple heat exchange, the apparatus can be calibrated more easily and less frequently than existing analyzers. Decomposition can be carried out over a broad temperature range.

5805 APTIC NUMBER 18699

Hall, Freeman F., Jr. and Harris T. Ageno
LIDAR INVESTIGATIONS OF THE SPATIAL DISTRIBUTION AND SIZES OF DROPLETS IN SPRAY PLUMES FROM OCEAN WAVES. McDonnell Douglas Corp., Huntington Beach, Calif., Douglas Advanced Research Labs., Res. Commun. 59, Paper 5015, 15p., May 1968. 9 refs. (To be published in the Proc., Conf. on Radar Meteorology, 13th, Am. Meteorol. Soc., 1968.)

Use of a pulsed ruby laser to map the three-dimensional development of spray plumes generated by wave action on an isolated rock at Reef Point, near Laguna Beach, California, proved the feasibility of this technique for observing spray diffusion. Observations of plume diffusion under varying conditions of sea breeze and sea state over the 200 m path from the reef to the shore showed plume height to be less than would be predicted by turbulent diffusion theory for smoke clouds in thermal equilibrium with the environment. The small vertical development is attributed to the strong thermal inversions which existed over the water when the investigation was conducted, and to settling of the larger spray droplets. Evaporative cooling of the plume may also limit vertical diffusion. The experimental procedure consisted of taking several shots at each laser altitude and azimuth setting to determine the mean plume envelope, and recording holograms of spray near the breaking waves and farther downwind to monitor the evaporation of the droplets. A better understanding of the generation of giant salt nuclei, so important in warm cloud rain, might be obtained by applying this lidar technique in the tropics. (Author abstract)

5806 APTIC NUMBER 18769

Halsam, O. T., P. L. Hershey, and R. H. Keen
EFFECT OF GAS VELOCITY AND TEMPERATURE ON RATE OF ABSORPTION. Ind. Eng. Chem., 16(12):1228-1230, Dec. 1924. 5 refs.

The values of the over-all absorption coefficients for gas and liquid were experimentally determined for sulfur dioxide and ammonia from 10-50 C and at a gas velocity of 0.03-1.5 feet/sec. These coefficients were investigated by means of the two-film theory. The dependence of the individual film coefficients upon gas velocity, temperature, and solute gas was calculated. Gas velocity is without appreciable effect on the liquid film in the apparatus that was used. The gas film coefficient

is proportional to the gas velocity to the 0.8 power. Absolute temperature has a different effect upon the two individual film coefficients. The gas film coefficient decreases as the 1.8 power of absolute temperature, while the liquid film coefficient increases as the fourth power of temperature. This wide difference in temperature effect is explained on the basis of the dependence of the gas and liquid film coefficients upon the ratio of density to viscosity of the film fluid. This ratio increases with temperature for the liquid film and decreases with temperature for the gas film. Both individual film coefficients are proportional to the two-thirds power of the ratio density/viscosity. This data supported Lewis and Whitman's statement that the molecular diffusivities of all solutes are identical. Calculations were made on the assumption that this is true for liquid film. The ratio of the calculated diffusion coefficients through the gas films, which according to the theory, should equal the ratio of the molecular weights, is within 15% agreement with the theoretical ratio.

5807 APTIC NUMBER 15039

Hamel, Paul
ANALYZING GAS CENTRIFUGE FOR FUEL FABRICATION. Can. Nucl. Technol., p. 48-53, Spring 1962. 4 refs.

The theory underlying the application of the gas centrifuge to the industrial-scale production of uranium fuel with low degrees of enrichment is reviewed, using a simple analytic model, pw equals constant, for clarity. A basis for evaluating the ability of separative work per unit time, regardless of the mole fractions of the material, is developed by establishing a proportionality between the 'value of a given quantity of separated material' and the number of centrifuge elements required to produce it. The countercurrent centrifuge is analyzed, and the factors determining the actual number of centrifuge elements required in a particular separation plant are discussed. A rational choice of the plant parameters should be made from an over-all optimization study including local economic effects. High peripheral velocity is at a premium, but its achievement is strongly dependent on the related technologies for vacuum systems, mechanicl sealing devices and bearings. Short but broad cascades of centrifuge elements are obtained from theoretical analysis. This suggests the sectional type of cascade arrangement, where sections are added as the need arises. From an inspection of the total number of elements, stages and flow rates required, it appears that a combination of the thermal diffusion and gas centrifuge methods should be considered in a comprehensive plant optimization study. For instance, the diffusion process could be used with advantage in the depleting sections of the cascade while employing gas centrifuges in the upper enriching stages. (Author conclusions modified)

5808 APTIC NUMBER 15108

Hartmann, H. and H. Kleman
LASER LINES FROM CO2 IN THE 11-18 MICRON REGION. Can. J. Phys., 44(7):1609-1612, 1966. 18 refs.

Presumed Q-branch lines were obtained for the 00(zero-th angular momentum state)1-10(zero-th ams)0 and 00(zero-th ams)1-02 (zero-th ams)0 vibrational transition bands of a CO2 laser equipped with a grating spectrometer and a Golay detector. The 11-18 micron region was also searched for other possible transitions. Prominent laser lines were observed at the wavelengths 11.012, 13.151, 13.537, 16.580, 17.024, and 17.372 microns. The lines in the 11.012 series are identified as the P branch of the 01(first ams)1-11(first ams)' transition. The transitions between 13-18 microns are believed to be CO2 Q lines. The possibility that some of the lines are P or R lines in perpendicular transitions is discussed.

5809 APTIC NUMBER 14412

Hassan, H. A. and F. Y. El Kady
HYDROPROCESSING OF A HIGH SULPHUR RESIDUAL PETROLEUM FRACTION FOR FUEL PRODUCTION. Indian J. Technol. (India), 7(3):87-90, March 1969. 11 refs.

The effect of initial hydrogen pressure and temperature on the hydrocracking of a high-sulfur asphaltic residual oil boiling above 270 C was studied. Hydrocracking was carried out in a static phase and the product distribution was studied under different operating conditions. Maximum yields of gasoline, kerosene, and gas oil were obtained at 450 C and with initial hydrogen pressures 50, 75, and 100 atm, respectively. The hydrogenation reaction predominated up to 400 C, but at 450 C, hydrocracking proceeded at a rapid rate. Both hydrogenation rate and hydrogen consumption increased with rise in temperature and hydrogen pressure. However, at 450 C and 25 atm hydrogen, the dehydrogenation reaction predominated. The hydrogenation reaction removes sulfur, nitrogen, and oxygen, as H2S, NH3, and H2O, and produces low molecular weight hydrocarbons. (Author abstract modified)

5810 APTIC NUMBER 15527

Hickling, Robert
HOLOGRAPHY OF LIQUID DROPLETS. General Motors Research Labs., Warren, Mich., Research Pub. GMR-869, 31p., April 10, 1969. 9 refs.
CFSTI: PB 185-570

Experiments with holograms of small clouds of water droplets are discussed. Essentially, the holograms are records of the light scattered by individual droplets in the far-field over a range of the scattering angle subtended by the width of the hologram. The radiation patterns of individual droplets in this angular range were determined from the reconstructed image of the droplet cloud; intensity plots of the patterns were recorded with a TV camera system and a chart recorder with a photomultiplier attachment. Particular attention was paid to radiation patterns in the theta range 10-40 deg, where theta is measured from the direction of propagation of the laser pulse

illuminating the droplet cloud. Experimental results are in good agreement with the Mie theory of scattering by liquid spheres, which predicts a significant relation between the form of the scattered radiation pattern and the diameter of a droplet. With holography, it is possible to determine droplet sizes with an accuracy of + or - 1%. (Author abstract modified)

5811 APTIC NUMBER 15369

Hochreiter, Frederick C. and Robert J. McCann
TRANSMISSOMETER CALIBRATION TECHNIQUES (FINAL REPORT).
Environmental Science Services Administration, Sterling, Va., Weather Bureau, Inter-Agency Agreement FA-65, WAI-96, Proj. 850-401-05F, RD 68-51, 116p., Sept. 1968. 13 refs.
CESTI: AD 682891

The subject of this report is the investigation, analysis, and specification of transmissometer techniques that do not require specialized calibration devices. Two side-by-side, 250-ft baseline transmissometers were used to isolate calibration techniques useful under all visibility conditions. Past calibration procedures were limited to application in visibility of 5 miles or more. The procedures can be successfully applied when the visibility is as low as 2 miles. Preventive maintenance procedures for minimizing transmissometer outages are discussed. Results show that projector lamp failures will be rare if the lamp is changed after 2500 hours of operation. The feasibility of replacing the projector lamp during low visibility conditions is indicated. The results of a transmissometer maintenance survey are presented. This survey reflects maintenance problems encountered by field electronic technicians and indicate areas for further improvements in techniques. Other data show that it is no possible to calibrate a transmissometer by using data from a nearby system on an airfield. (Author abstract modified)

5812 APTIC NUMBER 13770

Hodek, J., M. Zabransky, and J. Vosolsobe
STUDIES ON THE STRUCTURE OF A VANADIUM CATALYST BY MEASURING THE LOW-TEMPERATURE ADSORPTION OF SULPHUR DIOXIDE. Collection Czech. Chem. Commun. (Prague), 33(9):2807-2813, Sept. 1968. 11 refs.

Structural changes which arise during fabrication of a vanadium catalyst for the oxidation of sulfur dioxide were investigated. Structural characteristics were calculated from isothermal equilibrium data of sulfur dioxide adsorption at -15.5 C for the following four adsorbents: basic silica gel carrier, silica gel thermally dehydrated at 480 C, a catalyst having a vanadium pentoxide content of 9%, which was prepared by impregnation of the basic carrier and for the latter catalyst, activated in an integral reactor. The specific surface areas of samples and effective area of the sulfur dioxide molecule in a complete monolayer were determined from isothermal adsorption data of n-butane which were measured at 0 C. The structure changes and mechanism of adsorption on all four samples are discussed. (Author abstract modified)

5813 APTIC NUMBER 15764

Holliday, Michael and Bryan Reuben
THE REACTION OF HYDROGEN WITH NITROUS OXIDE. (La reaction de l'hydrogene avec l'oxyde azoteux). Text in French. Bull. Soc. Chim. France, no. 9:3087, 1969. 6 refs.

The mechanism of the reaction between hydrogen and nitrous oxide was discussed. The activation energy of the reaction was approximately 62.5 kcal. This was in accordance with the initial reaction, N2O yields N2 + O followed by a series of intermolecular chain-breaking reactions. The effect of adding nitric oxide to the system was also examined. Results were best explained by the reaction of OH and H radicals, rather than O radicals with nitric oxide. This mechanism was in agreement with the known rate constant of the reaction. Chemiluminescene was not observed in the slow reaction and it appeared that this was due to a relatively insignificant side reaction rather than a major termination process. (Author abstract modified)

5814 APTIC NUMBER 14570

Ivanov, V. N.
KINETICS OF NITRIC OXIDE DISSOCIATION STUDIED BY ABSORPTION SPECTROSCOPY. (Izuchenive kinetiki raspada okisi azota metodom absorbtsionnoy spektroskopii). Text in Russian. Izv. Akad. Nauk SSSR, Ser. Fiz., 27(1):35-37, 1963. 5 refs.

Dissociation of NO at concentrations of 0.32 to 1.94 times ten to the 19th power moles/cu cm at 650 C was studied by absorption spectroscopy, the rate of dissociation being determined from the intensity of the NO2 line. In all cases, equilibrium was reached in about 10 hrs. Introduction of 0.5% oxygen caused the dissociation rate to double, the resultant NO2 being the actual catalyzing agent. Comparison is made with contradictory data found in the literature.

5815 APTIC NUMBER 14583

Ivin, K. J.
REACTION OF NITRATES WITH LIQUID SULPHUR DIOXIDE. Nature, vol. 180:90, July 13, 1957. 7 refs.

The mechanism of inorganic nitrate catalysis of the formation of polysulfones from liquid mixtures of olefins and sulfur dioxide is suggested on the basis of the following observations. If sufficient silver nitrate is allowed to react with liquid sulfur dioxide, a brown gas appears but may disappear again. The brown gas is presumably nitrogen dioxide formed by processes such as NO3(-) plus SO2 yielding NO2 plus SO3(-) or NO3(-) plus SO3(-) yielding NO2 plus SO4(2-) and removed by further reactions with sulfur dioxide. In the presence of excess sulfur dioxide, the final products are likely to be nitrosyl pyrosulfate and nitric oxide, the overall reaction being: 6AgNO3 plus 7SO2 yields

3H2SO4 plus 2(NO)2S2O7 plus 2NO. The only three completely soluble nitrates as catalysts for polysulfone formation were those of lithium, silver, and ammonium. In liquid sulfur dioxide, it is to be expected that even with nitrate concentrations of 0.0001 M, there will be a considerable degree of dissociation of the ions. Hence the rate determining step for the initiation of polysulfone formation should be written as M(I)NO3(-) plus SO2 yields M(I) plus NO2 plus SO3(-). Nitrogen dioxide is known to attack olefins. The sulfite radical may equally well be the effective catalyst, since it has been known to initiate the polymerization of styrene. It was suggested that the effective catalyst is nitrogen dioxide and/or the sulfite radical formed as the primary products of the reaction between nitrates and sulfur dioxide.

5816 APTIC NUMBER 15051

Jacobs, G. B. and M. C. Powers
EXTENSION OF CO2-LASER WAVELENGTH RANGE WITH ISOTOPES. J. Appl. Phys., 38(6):2692-2693, May 1967. 5 refs.

Tunable laser emission in the 00(zero-th angular momentum state) 1-10(zero-th angular momentum state)0 and 00(zero-th angular momentum state)1-02(zero-th angular momentum state)0 bands in the isotope C(13)O2(16) and, in particular, a mixture of the two isotopes C(12)O2(16) and C(13)O2(16) are reported. By using C(12) and C(13) isotopes, a CO2 laser was made to lase at any one of about 200 lines from about 9.2-11.4 microns. By using optimum mixtures of the many possible combinations of carbon and oxygen isotopes, the lasing wavelengths range can probably be further increased at the extremities and the wavelength between adjacent lasing transitions further decreased. As a scanning source for spectroscopy, detector measurement, and propagation studies, the device described would have advantages of broader range, higher power, and higher resolution than usual sources.

5817 APTIC NUMBER 14800

Jander, Gerhart and Josef Weis
MOLTEN ANTIMONY(III)-BROMIDE AS AN IONIZING SOLVENT AND THE BEHAVIOR OF SUBSTANCES DISSOLVED IN IT. I. (Geschmolzenes Antimon(III)-bromid als ionisierendes Loesungsmittel und das Verhalten darin geloester Substanzen. I). Text in German. Z. Elektrochem., 61(10):1275-1283, 1957. 23 refs.

Molten antimony bromide (SbBr3) is an ionizing water-like solvent for a number of organic and inorganic substances such as KBr, PbBr, HgBr, FP, NH3P, KCl, Br2, I2, many hydrocarbons, amines, ketones, phenols, nitriles, and aldehydes, etc. A number of inorganic substances dissolved in molten SbBr3 crystallize as double compounds with the solvent, e.g., 7KBr.3SbBr3.8H2O and 2KBr.3SbBr3. This indicates that the substances dissolved in SbBr3 are to a large extent solvated. Pure molten SbBr3 has a low specific conductivity of 0.00005/ohm-cm at 100 C. By dissolving a substance in SbBr3, however, electric current conduction becomes as good as that of an aqueous electrolyte solution. The intrinsic conductivity is due to a small dissociation according to the equilibrium equation SbBr3 yields SbBr2(+) +Br(-).solv. According to this dissociation, substances which produce SbBr2(+) ions act as acids, and those which produce Br(-) ions act as bases. Base-analogous compounds are KBr, TlBr, and other bromides. Acid-analogous compounds are some antimony(III) salts. Various bromides of multivalent elements are 'potential electrolytes', which, when dissolved, form solvates which act as acids, e.g., AlBr3: AlBr3 +SbBr3 yields SbBr3.AlBr3 yields SbBr2(AlBr4). These results were obtained through study of the electrical conductivity and through cryoscopic determination of the state of dispersion.

5818 APTIC NUMBER 15743

Jeffrey, G. A. and R. K. McMullan
THE CLATHRATE HYDRATES. In: Progress in Inorganic Chemistry. F. Albert Cotton (ed.), vol. 8, New York, Interscience, 1967, p. 43-108. 211 refs.

A clathrate is a crystalline compound obtained by formation of a hydrogen-bonded water 'host' lattic around one or more species of 'guest' molecules or ions. The clathrate hydrates can be classified according to two criteria: the chemical nature and stereochemistry of the guest species; and the structure of the water host lattice. The former indicates which substances have been found, or might be expected to form clathrate hydrates; the latter gives a detailed geometrical description of the structures that are formed. Classification based on the expected interaction of a solute species with its water environment on crystallization is less definitive than that based on the structure of the water host lattice. To emphasize the geometrical patterns formed by the water molecules, this review of the behavior of water molecules under the influence of intermolecular cohesive forces was prepared with a structural bias. Although the substances that form hydrates are diverse in their chemical properties, host structures with few exceptions include the H20O20 pentagonal dodecahedron. However, this general rule may not apply to amine hydrates. Within the next few years, the category of cage-like hydrates may be extended to include more than are described here. If there is more variety in the ways in which water can form cages or sheaths about other molecules, the development of a hydration chemistry can be expected. This chemistry will require the same kind of basic structural rationale as silicate chemistry. Hydrate lattices have weaker bonds than those of silicates and can exist only at lower temperatures, but they are more readily formed and might be expected to exhibit even greater variety. The possibility of ionic substitution such as replacement of H2O, NH4(+), F(-), and other hydrogen-bonded anions needs systematic exploration.

5819 APTIC NUMBER 14548

Jindal, Hans R. and George W. Harrington
REFRACTOMETRY IN FUSED ALKALI NITRATES AND THIOCYANATES. J. Phys. Chem., 71(6):1688-1698, May 1967. 20 refs.

Refractive index and density measurements were performed on various alkali nitrates, alkali nitrate mixtures, and solutins of alkali halides in the nitrate systems. In addition, molten alkali

thiocyanates and saturated aqueous solutions of alkali thiocyanates were studied. Molar refractions, polarizabilities, and fundamental frequencies were calculated. It was found that the molar refraction increases slightly with temperature. The added alkali halide has a different molar refraction than NaNO3 and makes a different contribution toward the total molar refraction and it is the sum of the contributions of the two components which equals the calculated value. That is, for additions of LiCl to NaNO3, there was a decrease in the molar refraction, for NaCl addition, there was a slight decrease, and for KCl additions, there was a slight increase. The results of LiCl, NaCl, and KCl additions to (Na, K)NO3 eutectic also justify the additive character of molar refraction in the case of these three-component systems. This also held for thiocyanate mixtures. It was concluded that the mixture behaves from the molar fraction point of view as if the ions of the two components did not influence each other. Values for the radii of NO3(-) and NCS(-) ions were in reasonable agreement with the overall radii calculated from consideration of reported covalent bond lengths and ionic sizes. Values for the characteristic absorption frequencies had the same order of magnitude as those already reported. It appeared that the magnitude of the first absorption frequency is not as influenced by the nature of the cation as is the second absorption frequency. Saturated solutions of pure KSCN and KSCN-NaSCN eutectic were examined for similarities. In each case, the extrapolated intercept of the aqueous solution and melt plots occurred at the melting point of the salt and eutectic. The study suggested that aqueous solutions of alkali nitrates and nitrites would show considerable curvature at higher temperatures. The linearity in the case of thiocyanates may be merely the result of a fortuitous combination of effects.

5820 APTIC NUMBER 15615

Jirous, Frantisek
THE EFFECT OF THE ENTHALPY OF THE FLY ASH ON THE ENERGY BALANCE OF A HEATED SURFACE AND ON THE REMAINS' LOSSES. (Der Einfluss der Enthalpie der Flugasche auf die Energiebilanz der Beruehrungsheizflaechen und auf den Abgasverlust). Text in German. Brennstoff-Waerme-Kraft, 21(9):490-2, Sept. 1969. 9 refs.

An error arises in the energy balance by neglecting the enthalpy of the fly ash. This influences the boiler efficiency. The error becomes apparent when the fly ash concentration varies. In reality, the contact heating surfaces are designed with sufficient reserve so that the effects from neglecting the enthalpy of the fly ash do not necessarily become apparent. However, if the fly ash concentration varies considerably, the boiler efficiency might be strongly impaired. A diagram is given for computing the error. A table indicates the enthalpies of flue gases and fly ash, as well as the errors occurring at various flue gas temperatures.

5821 APTIC NUMBER 18875

Johnstone, H. F. and M. W. Darbyshire
SULFUR DIOXIDE AS A RAW MATERIAL: CHLORINATION OF METAL OXIDES WITH SODIUM CHLORIDE AND SULFUR DIOXIDE. Ind. Eng. Chem., 34(3):280-286, March 1942. 25 refs.

Certain ores, readily chlorinated by the combined action of sulfur dioxide, air, and salt were studied. The products, in general, are the anhydrous sulfates and chlorides. These anhydrous salts may have commercial value even greater than their importance in chemometallurgy. In the case of iron oxide ore the production of pure anhydrous ferric chloride by volatilization is handicapped by the unusually low vapor pressure of sodium chloride solutions in the product. The results of this work show the possibility of producing chlorine from sodium chloride by the action of sulfur dioxide and air in the presence of a catalyst. Whether the economics will favor the use of these gases rather than sulfur trioxide from the contact converters cannot be stated until the space-time-yield studies are completed. The accelerated attack of mixtures of sulfur dioxide and chlorine on ores might be used as a source of anhydrous sulfates. In this case chlorine acts only as an intermediate compound; once the chloride is formed from the oxide it is readily converted to the sulfate by gases rich in sulfur dioxide and oxygen, the chlorine being regenerated. This mechanism prevails in the case of ferric oxide and apparently takes place to some extent with even more refractory ores such as zircon. The mechanism suggests that a continuous countercurrent process might be used in which the ore is fed into one end of a continuous shaft or rotary furnace while sulfur dioxide and air are blown into the other end. A small amount of sodium chloride or other chloride may be present with the ore, or some chlorine may be added with the gases. As the solid charge travels forward, the oxide is first converted to the chloride. At higher temperatures and in the presence of excess sulfur dioxide and oxygen, the chloride is converted to sulfate and chlorine travels with the gas to the oxide end of the furnace. (Author conclusions modified)

5822 APTIC NUMBER 18917

Jonathan, Neville
INFRARED SPECTROSCOPY APPLICATION TO CHEMICAL KINETIC SYSTEMS. Southampton Univ., Southampton, England, Dept. of Chemistry, Contract AF61(052)-886, Proj. 8658-03, APCRL-69-0055, 20p., Oct. 21, 1968. 15 refs.
CFSTI, DDC: AD 683 772

Work carried out on atom-molecule and atom-atom reactions in the gas phase is reported. A zeolite pump was designed for studying the reactions at fast flow rates and low pressures. Results are given of studies on three light emitting reactions: atomic oxygen plus nitric oxide, atomic nitrogen recombination, and atomic oxygen plus acetylene. The mechanism by which ozone is adsorbed on silica gel was investigated using infrared absorption spectroscopy. Spectra were obtained for ozone, carbonyl sulfide, and sulfur dioxide adsorbed on an Aerosil pressed disc sample. In each case, a new band was detected at a lower frequency than that due to unperturbed hydroxyl groups, and the new band was found to increase in intensity as the latter decreased. Shifts were measured at various temperatures, and the results explained in terms of the formation of a hydrogen bond between the hydroxyl group on the adsorbent surface and the adsorbate molecule. The temperature dependence of the shift is also consistent with the known properties of the hydrogen bond.

... temperature is increased, the hydrogen bond becomes weaker, ... the frequency of the hydroxyl band approaches the value for a free hydroxyl group. It is suggested that both ozone and sulfur dioxide are adsorbed on silica gel through their central atoms rather than through their terminal oxygen atoms.

5823 APTIC NUMBER 15261

Jones, A. Vallance
INFRA-RED AND ULTRAVIOLET SPECTRA OF SULFUR MONOXIDE. J. Chem. Phys., 18(9):1263-1268, Sept. 1950. 13 refs.

The infrared spectrum of sulfur monoxide, prepared by Schenk's method, was examined between 400 and 2000 reciprocal cm. Bands were observed at 679 and 1165 reciprocal cm. The ultraviolet absorption band system discovered by Schenk in the region 3500-2500 A was obtained under high resolution. A very sharp predissociation occurs at 31,702 reciprocal cm leading to an upper value for a dissociation limit of 91 kcal/mole. A ground state vibration frequency of 679 reciprocal cm was deduced from a partial analysis of the electronic absorption band system. It is shown that the molecule cannot be diatomic, but probably has the formula S2O2, as suggested by Kondrat'eva and Kondrat'ev. A structure is proposed which is supported by spectroscopic evidence. (Author abstract modified)

5824 APTIC NUMBER 13585

Jordan, C. W., A. L. Ward, and W. H. Vulweiler
GUM DEPOSITS IN GAS DISTRIBUTION SYSTEMS. VAPOR-PHASE GUM (CONTINUED). Ind. Eng. Chem., 26(10):1028-1038, Oct. 1934. 10 refs.

A study of the effect of the vapor-phase gum accumulating on the adjusting needles of gas pilot lights showed that the amount of gum required to extinguish an ordinary pilot light is 0.000065 g and that the gum is produced by the catalytic oxidation of nitric oxide to nitrogen peroxide followed by the reaction of the peroxide with unsaturated hydrocarbons. Freedom from the vapor-phase gum can be assured only when the quantity of nitric oxide is on the order of 0.000005% or lower by volume. Since combustion products are the principle source of nitrogen oxides, the formation of vapor-phase gum can be controlled at its source. A suggested method of reducing nitrogen oxides is to reduce the negative pressure on retorts or ovens and to purge combustion products in water-gas sets, thereby producing a blue gas containing less than 3% total nitrogen. Methods involving oil scrubbing and steam spraying had no appreciable effect on nitric oxide.

5825 APTIC NUMBER 15189

Jordan, I., W. Kolbe, and E. Borges da Silva
SEPARATION OF STABLE ISOTOPES BY THE GAS CENTRIFUGE METHOD: INFLUENCE OF THE AXIAL PRESSURE ON THE SEPARATION OF ARGON ISOTOPES. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 3rd, Geneva, 1964, vol. 12:358-364. 9 refs.

Work on isotope separation by gaseous centrifuging was continued by investigating the axial pressure dependence of the enrichment and separative power for the separation of argon isotopes. Experiments were conducted in countercurrent gas centrifuges that are controlled by thermal convection. These centrifuges consist essentially of a hollow, vertical rotor into which gas of natural isotropic composition is fed through the inner tube of the double-walled, highly elastic and rotating upper axis. The countercurrent inside the rotor is produced by thermal convection when a temperature difference is maintained between the rotor covers. The depleted fraction and the enriched fraction are withdrawn from the rotor through the outer tube of the upper axis and through the lower rotating axis by means of a vacuum pump. The separation factor was determined as a function of the total flow or throughput rate at a fixed axial pressure and for several temperature differences. At total reflux and for each axial pressure, there is an optimum temperature difference between the rotor covers, corresponding to the optimum internal flow which leads to the maximum enrichment factor. As the axial pressure becomes smaller, the flow profile inside the rotor deviates more and more from the optimum flow profile, so that small values for the separation potential are obtained.

5826 APTIC NUMBER 13816

Joseph, M. I. and W. J. Sanders
LEUCYNE AMINOPEPTIDASE IN EXTRACTS OF SWINE MUSCLE. Biochem. J., Vol. 100, p. 827-832, 1966. 15 refs.

Leucine aminopeptidase was demonstrated in swine muscle at a level of activity one-fifth that of the swine kidney. The enzyme was purified 110-fold by precipitation with ammonium sulfate, heat treatment and chromatography on Sephadex G-100. The enzyme is heat-stable, but is rapidly inactivated below pH7. It requires Mg(2 plus) or Mn(2 plus) for activity. The Michaelis constant for leucine amide with Mg(2 plus) activated enzyme is .005M. It is concluded that muscle leucine aminopeptidase is very similar to the kidney enzyme.

5827 APTIC NUMBER 15076

Kagan, Yu. and V. A. Maksimov
KINETIC THEORY OF GASES TAKING INTO ACCOUNT ROTATIONAL DEGREES OF FREEDOM IN AN EXTERNAL FIELD. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 24(6): 1272-1281, June 1967. 18 refs.

An equation is developed to express kinetic phenomena in a polyatomic gas having rotational degrees of freedom in a magnetic or electrical field. It is solved by perturbation theory methods. Development of the equation is based on an expansion of the nonequilibrium distribution function in terms of the eigenfunctions of the ideal collision operator, which considers

only the change in the translational degrees of freedom in collisions between molecules. The irreducibility tensors of the velocity vector and rotational movement are described by spherical polynomials. The perturbation theory is developed in terms of a small parameter, that is, the degree to which complete collision deviates from an ideal one. Calculation of the effect in an external field is thus reduced to finding the eigenfunctions of the ideal collision operator and determining the matrix elements of the perturbing collision operator. Expressions are obtained for the influence of a magnetic field on the transport phenomena of viscosity, thermal conductivity, diffusion, and self-diffusion in paramagnetic and nonparamagnetic gases. Analyses of these transport phenomena show that in a magnetic field there are both odd and even effects. As a result, the general viscosity tensor in a magnetic field has seven independent coefficients (five even and two odd) and the thermal conductivity, diffusion, and self-diffusion tensors have three independent coefficients (two even and one odd). In an electric field, the number of coefficients is reduced, and all odd coefficients vanish indentically.

5828 APTIC NUMBER 15263

Kagan, Yu. and L. Maksimov
TRANSPORT PHENOMENA IN A PARAMAGNETIC GAS. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 13(3):604-610, March 1962. 8 refs.

A kinetic equation for molecules with rotational degrees of freedom is used to develop a theory for transport phenomena in a paramagnetic gas in an arbitrary magnetic field. From it, a satisfactory interaction model is derived for investigations of the transport phenomena (thermal conductivity), first viscosity, and diffusion as functions of the magnetic field. The model assumes that the nonsphericity of the molecules is small and that it is difficult for the momentum of a molecule to change after collision. The effect of nonsphericity is believed to manifest itself in the dependence of the cross sections of the angle between the moments of the molecules and the direction of the relative velocity. An explicit expression for the thermal conductivity tensor in a magnetic field is deduced and comparison is made with the experimental results on the Senftleben effect.

5829 APTIC NUMBER 13775

Kalinowski, Bohdan and Rafal [illegible]darski
ELECTRIC PROPERTIES OF PETROL[illegible] COKE FROM PIPELINE CRUDE OIL. (Własności elektryczne koksu naftowego z ropy rurociągowej). Text in Polish. Przemysl Chem., 47(7):408-410, 1968. 2 refs.

Resistivity, which is one of the fundamental properties of petroleum coke, depends on many factors, including the grade of coke obtained, the content of mineral components, the sulfur content, and the processing temperature. Grains of petroleum coke from pipeline crude oil underwent thermal treatment for 60 to 300 min at 1100 to 2700 C. After cooling, resistivity was measured at room temperature. (Author abstract modified)

5830 APTIC NUMBER 15187

Kammermeyer, Karl and Darrell D. Wyrick
EFFECT OF ADSORPTION IN BARRIER SEPARATION. Ind. Eng. Chem., 50(9):1309-1310, Sept. 1958. 12 refs.

Separation experiments were carried out with mixtures of propane and carbon dioxide in flow through porous glass as the microporous barrier to determine if porous barriers are affected by the differences in the adsorbability of the components. The experiments show that components of essentially equal molecular weight can be separated on the basis of differences in adsorption on a microporous barrier. Mixtures of propane and carbon dioxide gave appreciable enrichment in propane, the more condensable component, entirely on the basis of adsorbed flow. It is concluded that mixtures can be effectively separated with barriers by utilizing differences in the adsorbed flow of the components by proper adjustment of operating conditions. Studies are under way to establish the degree of adsorption of propane and carbon dioxide on the porous glass barrier under the conditions of the separation experiments.

5831 APTIC NUMBER 15064

Kammermeyer, Karl and Lenard O. Rutz
GAS AND VAPOR FLOW IN MICROPOROUS BARRIERS. Chem. Eng. Progr. Symp. Ser., 55(20):163-169, 1959. 23 refs.

To study condensed flow in microporous barriers, a series of permeability experiments was carried out with hydrogen, helium, nitrogen, oxygen, argon, and carbon dioxide on a porous-glass barrier with a pore size of 40 to 50 A in diameter. Operating conditions covered essentially room temperature (25 C) and pressures from moderate vacuum to 115 lb/sq in. abs. The most consistent and reliable data were obtained by operating the permeability cell at atmospheric pressure on the downstream (back pressure) side and at superatmospheric pressures on the upstream fore pressure) side. All the compounds exhibited condensed flow as a result of the capillary character of the barrier. A surprising finding was the constancy of the total permeability over the pressure range covered. Permeability measurements carried out at subatmospheric back pressures and at fore pressures up to 25 lb/sq in. gauge for helium, nitrogen, oxygen, and carbon dioxide gave rather unsatisfactory results. Only one series of permeabilities was obtained when both fore and back pressure were below atmospheric pressure. The experiments were made with nitrogen, and operation at three different pressure levels gave almost identical permeability readings. On the basis of the constancy of permeabilities obtained in the experiments with various gases, the possibility of correlating condensed flow with some physical property of the compounds, such as boiling point or critical temperature, is discussed. The experimental results are also interpreted as giving indirect evidence of helium adsorption. It is concluded that the assumption of nonadsorbability of helium is not justified, and that the use of helium as a nonadsorbable

gas at moderate pressures and temperatures for comparison purposes in determining the amount of surface flow must be re-examined.

5832 APTIC NUMBER 15123

Kammermeyer, Karl
SEPARATION OF GASES BY DIFFUSION THROUGH SILICONE RUBBER. (Selas Corp. of America, Dresher, Pa.) U. S. Pat. 2,966,235. 5p. Dec. 27, 1960. 2 refs. (Appl. Sept. 24, 1958, 5 claims).

A thin, nonporous membrane of silicone rubber, or other silicone polymers is described for use in separating gases in commercial quantities, and particularly for separating carbon dioxide from a gas mixture containing CO2 and an inert elemental gas such as hydrogen, nitrogen, oxygen, and helium. This type of membrane increases the flow rate of CO2, and has at least as high or higher selectivity for the gas than other plastic or rubber membranes. The permeation of CO2 through such membranes is much higher than that of the other gases on a relative basis. The process comprises bringing a mixture of gases containing carbon dioxide into contact with one side of the silicone rubber membrane, which causes a portion of the mixture to permeate the membrane, and removing a carbon dioxide enriched mixture from the other side of the membrane. To obtain separation or enrichment of a mixture it is essential that not all of the mixture be permitted to pass through the membrane; the degree of enrichment will decrease as a larger proportion of the mixture permeates the membrane. Also, it is desirable to use the thinnest membrane that will withstand the pressure drop across it. The membrane described consists essentially of a diorgan polysiloxane rubber, a substantial part of which is a polysiloxane having the formula $((CH_3)_2SiO)_n$ where n is an integer above 500. Details of the composition and fabrication of the membrane, and permeability test data, are given.

5833 APTIC NUMBER 15188

Kammermeyer, Karl
SILICONE RUBBER AS A SELECTIVE BARRIER. Ind. Eng. Chem., 49(10):685-686, Oct. 1957. 5 refs.

Permeability and gas separation data were obtained for supported silicone rubber sheets. The silicone films exhibited unusual selectivity for specific gases. The permeability toward carbon dioxide was exceptionally high compared with all other known plastic film materials. The selectivity of carbon dioxide permeation in relation to other gases such as hydrogen, oxygen, and nitrogen also was as high as that of natural rubber and polybutadiene, the two polymers known for preferential carbon dioxide permeation. It was found that silicone rubber membranes are very much faster membranes than any other films which have been reported. As silicone films can withstand very much higher temperatures than the organic materials, and the glass fiber-silicone sheet combination is fairly rugged, silicone rubbers clearly constitute very promising barriers for gas and vapor separations. With the present information that is available, permeability and flow properties of silicone rubbers can be compounded to meet specific requirements. Silicone resin and rubber barriers may be applied to gas-gas, gas-vapor, and vapor-vapor systems. The selectivities of the barriers investigated were very good, and the rates of permeation are of a magnitude that a one hundred-fold reduction in operating areas can be expected compared with other films presently available.

5834 APTIC NUMBER 14681

Kapustinksy, A. F.
THERMODYNAMICAL THEORY OF SULPHURIC ACID PROCESSES. Compt. Rend. Acad. Sci. URSS, 53(8):719-722, 1946. 16 refs.

The manufacture of sulfuric acid, regardless of the production method and catalyst employed, is based on the equilibrium reaction SO2 plus 1/2O2 yields SO3. With the aid of known specific heats of gaseous reagents, equations for calculating the free energy and heat of the reaction were derived from previously determined equilibrium constants for the formation of sulfur trioxide from sulfur dioxide and oxygen on a platinum catalyst. Standard values of these thermodynamic functions are shown and compared with those contained in the literature. The absolute entropy of liquid sulfuric acid and its heat of formation under standard conditions are given, as well as the absolute entropy of gaseous sulfur trioxide. The proposed thermodynamic theory of the sulfuric acid process makes it possible to represent as a single system, data constituting the basis of all sulfuric acid production methods for the oxidation of sulfur dioxide by oxygen.

5835 APTIC NUMBER 14653

Kapustinskiy, A. F.
ON THE PHYSICOCHEMICAL THEORY OF OBTAINING SULFURIC ACID BY THE CONTACT METHOD. (K fiziko-khimicheskoy teorii kontaktnogo sposoba polucheniya sernoy kislotY). Text in Russian. Issled. Po Prikl. Khim., Akad. Nauk. SSSR, Otd. Khim. Nauk, Sb., 1955:22-38. 38 refs.

This study examines the formation of SO3 from SO2 and oxygen, the thermodynamics of SO3 synthesis, and the mechanism of catalysis in this synthesis. The study of the dissociation equilibrium of SO3 at high temperatures over platinum using modern measuring techniques is described. A rigorous thermodynamic analysis of available results, based on classical thermodynamics, was made without any assumptions or approximations and was found to be in agreement with spectroscopic and calorimetric data. A structural-model approach is given to explain the catalytic action of platinum, proceeding from a proposed deformation of the molecules during adsorption, drawing on data from crystal chemistry and new information regarding molecular structure.

5836 APTIC NUMBER 15384

Karakhanyan, S. S., G. O. Grigoryan, and I. M. Nakhtesyan
COMPLEX PROCESSING OF COMMON SALT. III. DECOMPOSITION OF

APATITE CONCENTRATE BY AMMONIUM BISULFATE. Izv. Akad. Nauk Arm. SSR Khim. Nauk, 18(5):516-520, 1965. 8 refs. Translated from Russian by William C. Hunn. Tennessee Valley Authority Technical Library, Muscle Shoals, Ala., Translations, 7p., March 21, 1968.
CFSTI: PB 178107-T

The decomposition of apatite concentrate by bisulfate was studied at various experimental temperatures, NH4HSO4 concentrations, H2SO4 standards, and duration of slurry residence in the reactor. It was established that the optimum conditions for complete decomposition are 95 deg, NH4HSO4 concentration of 60%, an intermixing time of 120 min, and 164 parts by weight of NH4HSO4 for decomposing 100 parts by weight of apatite concentrate. The feasibility of a complex, double-component, nitrogen-phosphorus fertilizer is demonstrated. (In this fertilizer,) the content of plant nutrients totals 22.35%, of which P2O5 equals 13.9% and N2 equals 8.45%. (Author summary modified)

5837 APTIC NUMBER 15468

Karakhanyan, S. S. and G. O. Grigoryan
THE COMPLEX TREATMENT OF COMMON SALT. IV. THE DECOMPOSITION OF APATITE CONCENTRATE BY A MIXTURE OF AMMONIUM SULFATE-BISULFATE AND THE CHEMICAL MECHANISM OF THE PROCESS. Izv. Akad. Nauk Arm. SSR Khim. Nauk, 18(5):521-528, 1965. 8 refs. Translated from Russian by William C. Hunn. Tennessee Valley Authority Technical Library, Muscle Shoals, Ala., Translations, 8p., April 2, 1968.
CFSTI: PB 178108-T

The decomposition of apatite concentrate by a mixture of ammonium sulfate-bisulfate with a molar ration of NH3/SO4(2-) equals 1.33 was studied at various experimental temperatures, ammonium bisulfate concentrations, and acidity standards. It was established that the optimum conditions are a 90 deg, a sulfate-bisulfate concentration of 50-55%, and an intermixing time of 60 min. The possiblity of obtaining a complex nitrogen-phosphorus fertilizer with the ratio of N:P equal to 1:1 is demonstrated. At a full acidity standard, as determined by optical studies, theoretical calculations, and specific experiments, all the available phosphoric and hydride occurs in the form of monoammonium phosphate. Reduction in the acidity standard during decomposition of apatite concentrate is explained by the formation of diammonium phosphate resulting from the double decomposition reactions between the decomposition of dicalcium phosphate formed in the process and ammonium sulfate. (Author summary modified)

5838 APTIC NUMBER 13760

Karchmer, J. H.
GAS-LIQUID PARTITION CHROMATOGRAPHY OF SULFUR COMPOUNDS WITH BETA, BETA'-IMINODIPROPIONITRILE. Anal. Chem., 31(8):1377-1379, Aug. 1959. 6 refs.

The gas-liquid partition characteristics of 11 sulfur compounds in the 58 to 126 C boiling range were investigated using a column of beta, beta'-iminodipropionitrile on Celite. At 84 C and a helium flow of 70 ml per minute, this material resolves compounds on the basis of their electrophilic character. A log-log plot of the retention volumes obtained with the column against those obtained with a volatility delineating column produced a series of straight lines corresponding to tertiary mercaptans, primary isomercaptans, primary normal mercaptans, aromatics, and thiophenes. (Author abstract modified)

5839 APTIC NUMBER 15406

Karlov, N. V., G. P. Kuz'min, Yu. N. Petrov, and A. M. Prokhorov
Q-SWITCHING OF A CO2 LASER WITH A SATURATING FILTER BASED ON BORON TRICHLORIDE. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 7(5):134-136, March 1968. 3 refs.

Pulse generations were obtained in a CO2-N2-He laser by switching a saturating filter in the resonater; the saturation was produced in gaseous boron trichloride. The infrared absorption spectrum of gaseous BCl3 together with the P and R lines of the CO2 laser showed that the P and R lines agreed with the absorption bands of the ν3 (ν equal nu) vibrations of the molecules B(11)Cl3 and B(10)Cl3, respectively. The less active laser R lines correspond to the less abundant isotope B 10. Comparison of the data for the absorption coefficient of BCl3 with the gain of the laser discharge for the most active P lines shows that the cell with the BCl3 can serve as a saturating filter in a CO2 laser. Addition to the BCl3 of air in a 1:1 ratio at a pressure of 1 torr leads to giant pulses. More stable giant-pulse generation occurs when large amounts of helium are added to the BCl3. The best results are obtained by adding small amounts of ammonia to BCl3: in the pressure range of 1-7 torr, stable and perfectly regular generations of giant pulses are observed, with periods from 80 to 100 microseconds, depending on the pressure. When the pressure increases, the pulse repetition frequency decreases. In a cell containing BCl3 with ammonia, a highly effective resonant transfer of vibrational energy occurs by collision of the excited BCl3 molecules with the unexcited ammonia molecules, followed by rapid relaxation of the ammonia molecules to the ground state. Thus, the number of ammonia molecules should be much smaller than the BCl3 molecules, so that the absorption due to the ammonia does not exceed the absorption due to the boron trichloride.

5840 APTIC NUMBER 15232

Kemp, Edward V. W. and Clyde Orr, Jr.
HEAT TRANSFER TO A GAS CONTAINING A CLOUD OF PARTICLES. Georgia Inst. of Tech., Atlanta, Engineering Experiment Station, Grant NGR-11-002-003, Proj. A-635, 134p., Jan. 1969. 83 refs.
CFSTI: N69-19297

Particle cloud generation, optical properties of particle clouds, and particle gasification in addition to radiant heat transfer to particle clouds were studied. Four types of particle cloud generators were designed and tested, and their merits and

shortcomings are discussed. Extinction coefficients and the transmissivity of particle clouds were measured. The dependence of the wavelength of the radiation and the concentration of the particle cloud are considered. Experimental measurements of particle gasification were not obtained due to the lack of a sufficiently intense radiant source. Rates of radiant heat transfer to clouds composed of well-dispersed, non-luminous solid particles of known concentrations were measured. In agreement with theoretical predictions, clouds of smaller particles absorbed more radiant energy than those having the same mass concentration as larger particles. The absorption coefficient was found to be directly related to the cross-sectional area of the particles per unit volume of cloud. Equations are given which describe the rate of radiant heat transfer to particle clouds in terms of the mean beam length, particle concentration, density, and size. View factors were evaluated for a number of conditions when a cylindrical wall is the emitter. Both black and non-black walls were studied. Equations were derived to calculate view factors among zones of any size. A cylindrical tungsten furnace was built, and the rate of radiant heat transfer to clouds was measured. The data of carbon black clouds were in good agreement with theoretical values calculated from view factors. The data of alumina particle clouds were lower than carbon black due to low emissivity. Tungsten particles were found to deposit on the heating element after each test with a tungsten cloud. This phenomenon was not noticed when carbon black and alumina clouds were used. This analysis was intended to be useful in the evaluation of various nuclear rocket engine designs and in industrial high temperature applications. The information should also contribute to basic knowledge in the field of heat transfer and particle technology. (Author summary modified)

5881 APTIC NUMBER 14588

Kimhi, Yosef and Uriel Z. Littauer
PURIFICATION AND PROPERTIES OF POLYNUCLEOTIDE PHOSPHORYLASE FROM ESCHERICHIA COLI. J. Biol. Chem., 243(2):231-240, Jan. 25, 1968. 23 refs.

A method for the purification of polynucleotide phosphorylase from Escherichia coli was developed. The purified enzyme has a specific activity 700-fold higher than the crude extract. When enzyme fractions obtained at different stages of the purification were assayed by phosphorolysis of polyadenylic acid (poly A) or P-32-orthophosphate exchange with the 5' -diphosphates of adenosine, uridine, cytidine, guanosine, and inosine, the degree of purification at each step was approximately the same. Various factors affecting the exchange reactions between labeled orthophosphate and different ribonucleoside diphosphates were examined. An activating factor which enhances the ate of the ADP-P sub i exchange reaction 3- to 6-fold was isolated during the purification of the enzyme. It affects only the exchange reaction and not the phosphorolysis of poly A. It was found to be susceptible to proteolytic enzyme action, but not to RNase degradation. The effect of the dinucleoside monophosphate ApA on the polymerization and exchange reactions was studied. At low Mg(2+) concentration, it could overcome the lag period in the polymerization of ADP and also stimulate the ratio of the ADP-Pi exchange reaction. The results support the hypothesis that the polymerization and exchange reactions are catalyzed by the same enzyme. Their relation to the mechanism of the exchange reaction is discussed. (Author summary modified)

5882 APTIC NUMBER 16735

Klimisch, Richard L.
OXIDATION OF CO AND HYDROCARBONS OVER SUPPORTED TRANSITION METAL OXIDE CATALYSTS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968. 11 refs.

The reactivities of a series of potentially useful catalysts for the oxidation of carbon monoxide and propylene were examined, singling out the copper oxide-alumina system for more intensive study. Evidence was obtained which indicates that these oxides act as stoichiometric oxidizing agents for carbon monoxide. Mass-transfer limitations were examined in the copper oxide-alumina system for the oxidation of carbon monoxide and hydrocarbons at low concentration levels, showing the importance of this effect. The ease of catalytic oxidation of a series of hydrocarbons could be correlated with the atmospheric nitric oxide photooxidation rates of these hydrocarbons. The extent of the inhibition of these oxidation reactions by water and carbon dioxide at realistic exhaust gas concentration levels was also examined. Other more subtle features of these reactions were also examined, and explanations were offered in terms of simple mechanistic concepts where possible. (Author summary modified)

5883 APTIC NUMBER 15918

Kokurin, A. D.
MECHANISM OF COKE AND CARBON BLACK FORMATION DURING THERMAL PYROLYSIS AND DIFFUSION COMBUSTION. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 42(7):1498-1501, July 1969. 11 refs.

The mechanism of soot formation was studied by pyrolizing various hydrocarbons and their mixtures at 1000-1500 C. At the relatively low temperatures and low heating rates, and with considerable contact time, mainly polycyclic liquid (tarry) products were formed. They were converted to coke by further condensation. Carbon black formed at the higher temperatures as the result of the condensation of C2H and C2 radicals, which are incapable of forming liquid tarry products. Therefore, the quality of carbon black, i.e., its structure and dispersity, is determined by process conditions and the composition of the raw material. The higher the temperature and heating rate, the greater is the amount of raw material converted to carbon black and the less the amount converted to coke. The quality of carbon black differs in accordance with the degree of participation of radicals and macromolecular liquid products in its formation, the degree of

coking, and the contents of impurities, liquid particles, and cokes in the carbon black.

5844 APTIC NUMBER 14977

Krevelen, D. W. van, P. J. Hoftijzer, and C. J. van Hooren
STUDIES OF GAS ABSORPTION. IV. SIMULTANEOUS GAS ABSORPTION AND CHEMICAL REACTION. Rec. Trav. Chim., vol. 67:133-152, 1948. 3 refs.

Gas absorption with simultaneous chemical reactions between the solute gas and a reactive component of the liquid is an important unit operation in many chemical processes. Knowledge of this chemical absorption is scarce because the mechanism of absorption varies from one system to another. The influence of the concentration of the liquid is quite different in the cases of absorption of ammonia in sulfuric acid, carbon dioxide in alkaline lye solutions, and hydrogen sulfide in soda ash solutions. Rate-determining steps for three main types of chemical absorption were mathematically evaluated. For very slow reactions, the rate-determining step is the diffusion of the solute gas through the liquid film. Chemical reaction velocity is determinative for moderately rapid and slow reactions. For very fast reactions, gas film resistance to the solute gas and liquid film resistance to the reactive liquid component are rate determining. Rate equations were derived for the last group in terms of individual mass transfer coefficients. They were checked on absorption experiments on hydrogen sulfide in ammonia solutions, hydrogen sulfide in ammoniacal ammonium sulfate, and hydrogen sulfide in sodium carbonate-bicarbonate solutions. The experimental results were satisfactory.

5845 APTIC NUMBER 15190

Kronberger, H. and G. B. H. Geoghegan
SOME ASPECTS OF THE DESIGN THEORY FOR DIFFUSION PLANT STAGES. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. O. C. Nier (eds.), New York, Interscience, 1958, Chapt. 40, p. 513-517. 1 ref.

Experimental verification is reported of a theoretical expression for the separation of the isotopes U235 and U238 when a small fraction of uranium hexafluoride, containing U235 in abundance, is allowed to diffuse by a perfect molecular flow into a vacuum. It is further shown that the flow is no longer purely molecular if a membrane with larger holes is used. A satisfactory expression exists for the ideal separation of U235 and U238 and is applicable to the separation of other gas mixtures of similar velocities. When inverse pressure ratios must be considered and when incoming gas diffuses through a membrane assembly in the form of a duct with porous walls, expressions of separation can only be approximate. Optimal design of a diffusion plant stage requires fixing the known fore and back pressures for the membrane material used. Since the main pressure drop of the gas will be through the membrane, the problem is essentially one of finding a pressure ratio for which the separative power of the stage is greatest in relation to the pumping power. By using a higher ratio than one permitting minimum power consumption, the number of stages and hence capital cost of the plant can be reduced.

5846 APTIC NUMBER 14719

Krysenko, N. S. and D. F. Lisovskiy
PREPARATION OF OXIDIZED NICKEL ORES FOR ENRICHMENT OR SMELTING BY MEANS OF GAS REDUCTION AND SULFIDATION. (Podgotovka okislennykh nikelevykh rud k obogashcheniyu ili plavke putem gazovogo vosstanovleniya i sul'fidirovaniya). Text in Russian. Izv. Vysshikh Uchebn. Zavedenii, Tsvetn. Met., 2(5):50-58, 1959. 10 refs.

It was experimentally established that iron oxides and the silicate of ferrous oxide react with sulfur dioxide in the presence of a gaseous reducing agent to produce sulfur compounds. One hour at 900 C produces the following degrees of sulfidation: Fe2O3 40.0%, Fe3O4 35.8%, FeO 44.8%, and 2FeO-SiO2 29.6%. Increasing the temperature intensifies the process for a given gas composition. Such a process is adequate for most practical purposes, since smelting of oxidized nickel ore requires about 1.3 to 1.4% sulfide in the ore to extract Ni and Co. Reaction with a gas mixture containing CO, CO2, N2, and SO2 yielded elemental sulfur in addition to FeS. The degree of sulfidation by elemental sulfur in a neutral atmosphere increases with temperature, the apparent energy of activation in the range 600-900 C being 5358 cal. The data obtained are useful for improving sulfidation of oxidized nickel ore, especially in boiling-layer furnaces utilizing exhaust gases, and for intensifying the extraction of nickel and cobalt.

5847 APTIC NUMBER 15126

Lagrange, Pierre and Oleqh Milous
RE-ENRICHMENT OF DEPLETED URANIUM BY PASSAGE THROUGH A GASEOUS DIFFUSION INSTALLATION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 13:607-613. 6 refs.

The determination of the value of the uranium concentrates of different contents and, therefore, the cost of re-enriching them rests upon the choice of the price formula. This may be the result of very general considerations or may allow for specific production characteristics of the gaseous diffusion installation available. This article gives the evaluation of the cost of re-enrichment as computed from the general formula for various economic conditions, and reviews the case of a typical installation having a certain flexibility of operation and several feed points. It also gives an expression for the economic loss caused by mixture of products of different contents and thus gives a means of comparing the re-enrichment method using direct passage and the one by mixture. (Author conclusions).

5848 APTIC NUMBER 15395

Lange, Hermann
EFFECT OF DISSOLVED SUBSTANCES UPON THE SETTLING OF POWDERS IN AQUEOUS MEDIA. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):78-12, Nov. 1968. 6 refs.

When dust comes into contact with a liquid, particle wetting, suspension, and settling behavior are affected by liquid phase substances that are absorbed by the dust particles. If there is no permanent adherence between colliding molecules, the suspension is nonstable; if there is no adherence between molecules, the suspension is stable. Both types of suspension differ in their settling behavior, e.g., settling velocity and sediment volume. In general, nonstable suspensions can be stabilized by surfactants. This stabilizing effect and the relationship between sedimentation and absorption were investigated in experiments with graphite powders and powders of metal oxides and silicate minerals in solutions of surfactants and water. Increased surfactant concentration reduced sediment volume. Settling velocity was low at these concentrations. The highest level of stabilization occurred at low concentrations. With graphite in sodium dodecylsulfate, stabilization was determined by electrical repulsion and hydration of absorption layer. With graphite in a nonionogenic surfactant, dodecylnonaglycol, hydration of the absorption layer was sufficient for stabilization. The results show that adsorption of surfactants by nonpolar surfaces is primarily determined by the hydrophobic character of the hydrocarbon chain in the surfactant molecules. Experiments with polar metallic powders show that the absorption of surfactants in these cases is primarily effected by a specific interaction involving the hydrophilic group of the surfactant molecule or ion. Such interaction can consist, for example, of electrostatic forces, salt formation, or ion exchange. Consequently, for polar powders the adsorption of nonionogenic surfactants is usually less than for ionogenic surfactants with a similar hydrophobic group.

5849 APTIC NUMBER 13617

Langemann, Horst
MASS AND MOMENTUM EQUATION OF ISOTHERMAL NON-ISOBARIC GAS-LIQUID-PHASE-REACTORS. II. (Massen-und Impulshilanzgleichungen isothermer nichtisobarer Gas-Fluessigphasen-Reaktoren. II.) Translated from German. Brennstoff-Chem. (Essen), 49(10):312-315, Oct. 1968. 26 refs.

A model is described, which can be used to establish the momentum equation of a gas-liquid phase reactor with counter-flow of the phases. The basis of the momentum equation is the second law of motion by Newton, which in this case means: The temporal change of momentum of a mass element is equal to the vectorial sum of external forces acting upon it.

5850 APTIC NUMBER 15198

Large, L. N. and R. Hill
A COMPACT PULSED GAS LASER FOR THE FAR INFRARED. Appl. Opt., 4(5):625-626, May 1965. 8 refs.

Stimulated emission in the far infrared has been observed by a number of workers using pulsed electrical discharge through gases at low pressure. The spectrum is rich in oscillations between 16 and 120 microns when water vapor or heavy water vapor discharges are used; an oscillation has been reported at 337 microns using an HCN discharge. The power outputs from these laser sources far exceed anything previously obtainable for the far infrared. The resonators used in these experiments were several meters in length and the discharge tubes require subsidiary vacuum systems. To provide a more convenient source for this spectral region, a compact sealed-off laser was developed from the 8.8-m tube originally used. The source is designed to operate at 27.9 microns to take advantage of the strong oscillation obtained from the pulsed water vapor discharge at this wavelength. This region of the spectrum may be particularly useful for Faraday rotation measurements of magnetic fields in plasmas. (Author introduction modified)

5851 APTIC NUMBER 15805

Lasoski, S. W., Jr. and W. H. Cobbs, Jr.
MOISTURE PERMEABILITY OF POLYMERS. I. ROLE OF CRYSTALLINITY AND ORIENTATION. J. Polymer Sci., 36(130):21-33, 1959. 16 refs.

With the three polymers widely different in polarity, the water vapor permeability of unoriented films was shown to increase as the amorphous fraction increased. For polyethylenes, adherence to this relation is exhibited only with structures having densities above 0.94, a range in which the number of short chain branches is low. Films with densities lower than 0.94 exhibit higher film permeabilities than those calculated on the basis of the permeability of the amorphous areas of linear polyethylene. This results from the increase in the number of short chain branches and an increase in amorphous area permeability of the lower density polyethylenes. The variation of water vapor permeability with the square of the amorphous fraction may be theoretically accounted for by a linear variation of the diffusion and solubility coefficients with the amorphous fraction. With polyethylene terephthalate and nylon 610, the solubility coefficients exhibit this linear relation. The square permeability relation appears to be a limiting case for structures in which crystallization does not impose restraints on the segmental motions important in permeability. Where restraints do occur, as in oriented films, a higher order dependency on the amorphous fraction exists. This was exemplified with biaxially and uniaxially oriented polyethylene terephthalate films, with which it was shown that orientation in oriented crystalline films effects a decrease in permeability in addition to that ascribable to crystallinity. Only those oriented structures in which the orientation is locked-in, as by crystallization, exhibit a decrease in water vapor permeability. The relations of permeability and solubility coefficients to crystallinity have an important utility in that the extent of crystallinity or crystal density may be estimated with the proper data. On the bases of the literature, water vapor permeability data for two high density polyethylenes at three different vapor pressure differentials, the crystal density of polyethylene was estimated to be 0.995, 1.008, and 0.998 or an average of 1.00, in agreement with Bunn's value calculated on the basis of x-ray diffraction studies. (Author summary modified)

5852 APTIC NUMBER 14379

Lavrov, N. V.
PHYSICOCHEMICAL MECHANISM OF NATURAL GAS COMBUSTION. (Fiziko-khimicheskiy mekhanizm goreniya prirodnogo gaza). Text in Russian. Teoriya i Prakt. Szhiganiya Gaza, Nauchn.-Tekhn. Obshchestvo Energ. Prom., vol. 3:136-150, 1967. 12 refs.

The mechanisms of natural gas combustion are discussed in terms of oxidation and reduction of methane. This theoretical treatment is based on a review of the literature. The following topics are treated: physicochemical regularities in the process of fuel combustion; peculiarities of methane combustion; oxidation of methane; methane conversion reactions; chain mechanism of methane combustion; low-temperature oxidation of methane; mechanism of methane combustion at elevated temperatures (proposed by the author together with I. G. Petrenko); intermediate compounds and primary products of methane combustion. The proposed high-temperature combustion mechanism is based on the following assumption: chemical reaction with oxygen involves separate stages of thermal decomposition of methane; formaldehyde is regarded as an intermediate compound in the methane-oxygen reaction analogous to physicochemical complexes formed in carbon-oxygen combustion; methane combustion is subdivided into three stages (incomplete combustion to formaldehyde, decomposition of formaldehyde to CO and H2, combustion of CO and H2).

5853 APTIC NUMBER 15081

Lebovits, Alexander
PERMEABILITY OF POLYMERS TO GASES, VAPORS, AND LIQUIDS. Mod. Plastics, 43(7):139-142; 144; 146; 150; 194; 196; 198; 200; 202; 205-206; 208; 210; 213, March 1966. 119 refs.

Polymeric barriers have a variety of industrial uses but are subject to corrosion and degradation. The mechanism of the permeation process and the laws governing permeability of plastics are reviewed. The most important controlling factors in the case of polymeric materials are the chemical structure of the polymer, the nature of the permeant, the similarity or dissimilarity between permeant and barrier material, the temperature, and the pressure or concentration differential. The practical significance of permeability and the circumstances under which it is possible to predict performance of plastics as barrier materials are discussed and illustrated with examples. Selected permeability values are tabulated. This review of published permeability data is intended to serve as a guide to practical problems involving the permeability of plastics to gases, vapors, and liquids. (Author abstract modified)

5854 APTIC NUMBER 15408

Leva, Max and Chin-Yung Wen
GAS ABSORPTION. Ind. Eng. Chem., 53(5):417-419, 1961. 46 refs.

A brief review of some of the literature on gas absorption that appeared during 1960 is presented. The emphasis is on the most recent advances in gas-liquid correlations as they can be used in gas absorption processes. The literature is grouped under the following categories: flow-through equipment; absorption equipment tests; process data; bubbling flow, films, and liquid jets; liquid and gas mass transfer coefficients on packings; and reviews and miscellaneous studies. The topic treated by each paper is noted, and full citations are given.

5855 APTIC NUMBER 14878

Lewis, W. K. and W. G. Whitman
PRINCIPLES OF GAS ABSORPTION. Ind. Eng. Chem., 16(12):1215-1220, Dec. 1924. 13 refs. (Presented at the 68th Meeting of the American Chemical Society, Ithaca, N. Y., Division of Industrial and Engineering Chemistry, Sept. 8-13, 1924.)

Fundamental concepts developed from available data and from general laws of reactions between two phases of gas absorption are discussed. The rate of absorption is controlled by rate of diffusion of solute through the surface films of gas and liquid at the gas-liquid boundary. The relative importance of the two films is determined primarily by the gas solubility and to a lesser degree by the conditions of operation. Gas bubbles give very thin liquid films and are therefore particularly adapted to the absorption of the less soluble gases. On the other hand, the rates for the more soluble gases are limited by slow diffusion through the gas, and this effect becomes increasingly evident with gases above sulfur dioxide in solubility. Absorption through free liquid surfaces is enormously increased by stirring the liquid. The same general considerations hold for gas bubbles, but the liquid film is thicker relative to the gas film. For this reason, the effect of the gas film is less noticeable with sulfur dioxide, although with more soluble gases it comes into prominence.

5856 APTIC NUMBER 15135

Li, N. N., R. B. Long and E. J. Henley
MEMBRANE SEPARATION PROCESSES. Ind. Eng. Chem., 57(3):18-29, March 1965. 111 refs.

A summary of the literature investigating processes of permeation through polymer membranes, where the driving force for transport is hydrodynamic or osmotic pressure, is presented. The review is limited to gas diffusion processes; liquid permeation, and liquid dialysis and reverse osmosis processes. Gas permeation of polymers requires measurement of diffusion rates by either the time-lag or other methods. Effects on gas permeation of temperature, pressure and condensation, the nature of the penetrant, the polymer structure, irradiation, and film thickness are reviewed, as are the plasticizing effect, the permeability of graft polymers, and gas separation. Liquid permeation, or the permeating of mixtures from the liquid phase on one side of the film to the vapor phase on the other side, is potentially faster and cheaper than the gas process. The

mechanism of permeation; measured parameters; the effect of solvent concentration, polymer structure, and pressure and downstream concentration; and the prediction of permeation rates are considered. Dialysis as a unit operation considerably antedates gas and liquid permeations, and is in wide industrial use; reverse osmosis is a very recent process and is still undergoing initial development and pilot plant testing. The mechanisms of these processes are elucidated and the effects of osmotic pressure and membrane structure are discussed. The determination of membrane permeation constants and membrane diffusion coefficients is also described. Some test data are presented for liquid dialysis and reverse osmosis.

5857 APTIC NUMBER 15078

Li, N. N. and E. J. Henley
PERMEATION OF GASES THROUGH POLYETHYLENE FILMS AT ELEVATED PRESSURES. Am. Inst. Chem. Engrs. J., 10(5):666-670, Sept. 1964. 16 refs.

The permeability of polar and nonpolar gases (methane, ethane, propane, butane, ethylene, Freon-12, carbon dioxide, and nitrous oxide) in polyethylene film was studied at 15 to 80 C and film pressures to 11 atm. The effects of film thickness, temperature, and upstream and downstream pressures on gaseous permeation were determined. Carbon dioxide permeation through polyethylene obeys both Henry and Fick's laws. When upstream and downstream pressures are maintained at 1.57 and 1.0 atm, the permeation constant CO2 is temperature dependent, obeying the usual Arrhenius type relationship. The permeabilities of methane, ethylene, ethane, propane, butane, NO, and Freon-12 are pressure dependent, and the activation energies of these gases are functions of pressure. The observed correlation between permeability and increased pressure is further evidence of the strong plasticizing effect exerted by organic and inorganic polar vapors and gases. Both solubility constants and gas diffusivity are shown to be functions of pressure. Tested film thickness of 1, 2, 4, and 10 mil have no effect on the permeation constant. The effect of pressure on permeability is expressible by an exponential equation. The solubility constants of pressure-dependent gases can be correlated by a similar exponential equation, while diffusivity is calculated from permeation and solubility constants.

5858 APTIC NUMBER 14973

Lindner, Karl-Heinz
THE EFFECT OF ULTRAFINE GRINDING UPON THE CRYSTAL LATTICES OF DUSTS. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):43-52, Nov. 1968. 26 refs.
CFSTI: TT 68-50448/11

To determine the effect of grinding on the lattice structure of dust, minerals were subjected to intermittent grinding in a vibratory mill. Grinding samples were examined by X-ray analysis and electron microscopy. The crystal lattice of quartz, disthene, enstatite, and antimonite dusts was completely destroyed by intensive fine grinding. The disappearance of X-ray diffraction lines and the occurrence of scattering bands in all four substances indicates that the dust particles no longer possess an orderly lattice structure and can therefore be regarded as amorphous. This assumption is confirmed by the fact that the amorphous antimontrisulfide precipitated from the solutions (as well as the antimonite amorphized by grinding) has several scattering bands, and that the trend of the scattering curve of the quartz amorphized by grinding largely coincides with that of amorphous silicic acid. The changes in color and the recrystallization behavior of the antimonite samples are further indications of the complete destruction caused to the crystal lattice of the dust particles by grinding. It is assumed that in the case of amorphized dust particles an order of atoms or of molecules exists only within very narrow ranges (so-called short range order). The course of the specific surface curve, plotted as a function of grinding time, appears to be characterized by a rapid drop before grinding equilibrium is reached.

5859 APTIC NUMBER 14507

Linek, J. and F. Wala
LIQUID-VAPOUR EQUILIBRIUM IN SYSTEMS OF ELECTROLYTIC COMPONENTS. IV. THE SYSTEM K2O-SO2-H2O AT 60, 70, 80 and 90 C. Collection Czech. Chem. Commun. (Prague), 32(1):3817-3831, 1967. 10 refs.

Vapor-liquid equilibria were measured by the saturation method for the system K2O-SO2-H2O at 60, 70, 80, and 90 C over a concentration range of practical interest for the regeneration of potassium in the manufacture of terephthalic acid from potassium benzoate. The dependence of partial pressures of the components on the temperature and composition of the liquid phase is expressed by thermodynamically consistent equations. (Author abstract modified)

5860 APTIC NUMBER 14908

Lippincott, Ellis R. and E. Eugene Nelsh
INFRARED SPECTRA OF SOME SULFUR DIOXIDE SOLVATES. Spectrochim. Acta, vol. 123:123-128, 1961. 8 refs.

Infrared spectra were taken on solutions of sulfur dioxide solvates formed from alkali or alkaline earth iodides and thiocyanates soluble in acetonitrile. The three fundamental vibrations of liquid SO2 occur at 528, 1150, and 1340 inverse centimeters. The latter two frequencies were assigned to the symmetric and antisymmetric stretching modes respectively, and the frequency at 528 inverse centimeters was assigned to the angle bending mode. The two SO stretching frequencies significantly shifted in the spectra of the solvates. The bending frequency did not appear to be altered by the formation of the complex. The frequency shift seems to be independent of the nature of the cation. In view of the perturbed SO2 frequencies obtained in the infrared with complexes of SO2 with I(-) and SCN(-), it is postulated that these substances are charge-transfer complexes involving resonance forms. The infrared spectra of SO2 in solutions of KCl and KBr in acetonitrile gave no evidence of the existence of such species involving Cl(-) or Br(-).

5861 APTIC NUMBER 14661

Lisowski, Zbigniew
A MODIFIED CONTACT-DIFFUSION METHOD FOR THE DISCOVERY OF TRACES OF METAL. (Zmodyfikowana metoda kontaktowo-dyfuzyjna w zastosowaniu do wykrywania sladow metali). Text in Polish. Przeglad Lekar., 22(9):599-600, 1966. 5 refs.

A modification of the contact-diffusion method was reported for the finding of traces of metal at sites of body injury or clothing damage. A new universal and quick-drying metal solvent was introduced, which even in difficult conditions enables metal traces to be discovered. The shape of the metal can be reproduced if the surface was in contact with the tested substrate. (Author summary modified)

5862 APTIC NUMBER 15105

Liu, V. C.
NOTE ON DIFFUSIVE SEPARATION OF GAS MIXTURES IN FLOW FIELDS. J. Appl. Phys., 29(8):1188-1189, Aug. 1958. 9 refs.

The effect of pressure-diffusion flux upon the concentration distribution of gas mixtures in flow fields is discussed. The equation of concentration is formulated for a binary gas mixture in which the mass ratio is large and the concentration of the lighter gas is very small. An asymptotic solution to the steady-state equation of concentration is given for an irrotational and incompressible flow. The diffusive separation, that is, deviation from the original homogeneous state, of a mixture of helium and nitrogen along streamlines at the entrance to a long straight channel was calculated, and is presented as an illustration. It was assumed that the pressure inside the channel is 90% of that in the free stream, and that the diffusion coefficient corresponds with the atmospheric conditions at 80 km altitude. (Author abstract modified)

5863 APTIC NUMBER 15401

Liu, V. C.
ON THE SEPARATION OF GAS MIXTURES BY SUCTION OF THE THERMAL-DIFFUSION BOUNDARY LAYER. Quart. J. Mech. Appl. Math., Vol. 12(Part 1):1-13, 1959. 20 refs.

The formation and characteristics of the boundary layer of thermal diffusion existing along the surface of a heated wall over which flows a mixture of gases of unequal molecular weights are discussed. Due to the existence of a temperature gradient in the boundary layer, a thermal-diffusion flux is set up such that the lighter gas tends to move to the hotter region and the heavier gas to the colder region. When the temperature of the surface is maintained at a much higher level than that of the free stream, the concentration of the lighter gas increases monotonically from its free-stream value at the outer edge of the boundary layer to a minimum value at the plate. The existence of an extremely high temperature gradient makes it possible to obtain significant diffusive separation of gas mixtures in the boundary layer of a laminar flow. From this consideration, a new method of separating gas mixtures by suction of the thermal-diffusion boundary layer was conceived. An analysis of the thermal-diffusion layer was made, using a flat plate with constant suction as a model and assuming that the concentration of the lighter gas is much smaller than unity. The strong stabilizing effect of suction on the laminar flow is a result of the reduced boundary thickness. The velocity and temperature profiles for the intermediate region have lower limits of stability, hence, the suction ratio over this region must be larger than 7.3 if laminar flow is to be maintained. (Author summary modified)

5864 APTIC NUMBER 15073

Livingston, R. S. and J. A. Martin
ELECTROMAGNETIC SEPARATION OF THE ISOTOPES OF THE HEAVY ELEMENTS. In: Proc. Symp. Isotope Separation, Amsterdam, 1957, J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.), New York, Interscience, 1958, Chapt. 50, p. 597-609. 11 refs.

Special high-resolution mass spectrographs were developed for the preparation of highly enriched isotopes of the heavy elements. These special purpose isotope separators and the techniques used in handling alpha-radioactive elements are discussed. The isotope separators used for one-mass-unit separations utilize most of the features of the calutron with a 24-in. radius. The material to be separated is vaporized in a temperature-controlled electric furnace. The vapor passes through a manifold region to arch chambers where it is dissociated and ionized in a hot-cathode gaseous discharge. The ions diffusing from the discharge, after being first accelerated and decelerated, subsequently pass into a free field region, and travel a nearly circular path to the collector. Stringent conditions must be imposed on beam width and ion sources. Linear magnetic shims are used to reduce the beam width, which emerges at wide angles from the sources. A redesign of the ion source was required for the separation of the isotopes of thorium and plutonium because of the higher vaporization temperature of the charge compounds $ThCl_4$ and $PuCl_3$. To achieve the required temperatures, heaters machined from graphite sheet were used for the charge-vaporizing furnace. Leakage of feed material and electrical breakdown of the acceleration system have so far characterized the separation of plutonium isotopes.

5865 APTIC NUMBER 15112

Livingston, R. S. and J. A. Martin
SPECIAL ISOTOPE SEPARATOR FOR IDENTIFICATION OR PURIFICATION OF RADIOACTIVE SPECIES. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.), New York, Interscience, 1958, Chapt. 51, p. 610-168.

A small isotope separator (a 180-degree mass spectrograph) was developed to operate in the 24-in. radius calutron system. The

unit requires less than one gram of feed material and provides for very high resolution. The compound of the element to be separated is placed in the charge bottle from which its vapor passes through a graphite orifice to the manifold area and then to the ionizing arc. Ions diffusing from the arc are accelerated to an energy of 65 keV and then decelerated to 38 keV at the exit slit where they pass into the separation region. The beam is defined at the 90 deg plane. Standard collectors are used with cover plates added to reduce the collector slot to 2 inches. The enrichment factors obtained from the scan are approximately 50 with respect to an isotope located one mass unit below the isotope being enriched. Operation up to the present has been with various chlorides of the rare-earth elements and with UCl3, primarily to measure the performance with heavy elements at elevated temperatures. It is intended that this separator will supplant larger high-intensity calutron units for special applications that arise in nuclear physics and radio chemistry programs, and for the preparation of small amounts of especially high purity plutonium and uranium isotopes where insufficient material is available for multistage processing.

5866 APTIC NUMBER 14998

Loeffler, Friedrich
THE ADHESION OF DRY PARTICLES TO FIBROUS AND PARTICULATE SURFACES. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):29-36, Nov. 1968. 17 refs.
CPSTI: TT 68-50848/11

Experimental investigations into the problem of adhesion of quartz and limestone particles of irregular form (diameter 5-15 microns) on polyamide, polyester, and glass fibers, according to a 'blow off' method are reported. The measured adhesion distributions are very wide and extend over more than one order of magnitude. Adhesion increases with increasing particle size, air humidity, and filtration velocity. The median values of the adhesion distribution for the investigated systems are in the 1 to 10 mdyn range. Comparison of the theoretical evaluations with the measured values were in good agreement with the van der Waals forces which are primarily responsible for adhesion. The blow-off velocities prove that particles deposited at the fibers adhere firmly. A comparison with the flow velocities commonly used in filtration reveals that individual particles are hardly likely to be blown off even from dry fibers without a primary layer, since the required flow velocities are far from being approached in filter practice. However, it cannot be concluded that filters can be operated at much higher velocities, as with increasing velocities the proportion of rebounding particles rises greatly. The decrease of separation efficiency with particle size or filtration velocity is less due to the redetachment of already separated particles, but rather to rebound phenomena. As shown by experience, the considerable dust quantities accumulated at filters can lead to dust breakthroughs which do not involve the detaching of individual particles, but of entire cakes. This is due to the fact that the considerable forces acting upon the high dust piles are transferred to the fibers at relatively few contact points, leading to detachment. Measurements indicate that in this case the required detachment velocities are lower than for individual particles. Also, the first detachments only occur at blowing velocities above the filtration velocities. (Author conclusions modified)

5867 APTIC NUMBER 15720

Loudon, Robert G., Robert A. Prantz, Jr., and Charles A. LeMaistre
LABORATORY FOR THE STUDY OF MYCOBACTERIAL AEROSOLS. Am. Rev. Respirat. Disease, 100(2):160-168, 1969. 13 refs.

The construction and equipment of a laboratory for the study of mycobacterial aerosols were described. Air movement control, ultraviolet irradiation, and the use of safety hoods provide an environment in which workers can operate safely. In particular, the characteristics of the rotating drum for the study of static aerosols was described. The loading characteristics of the drum are given. After approximately 90 minutes, the addition of further aerosol is more or less compensated for by the rate at which aerosol is exhausted, and the drum is fully loaded. After an initial period of equilibration, the concentration of aerosol falls at a relatively constant rate. Physical decay of the aerosol is remarkably slow. Fifty percent of the particles were still airborne at two and one-half days; thereafter, the concentration of particles was halved approximately every five days. It was concluded that quantitative information can be obtained on the ability of organisms to survive aerosolization, aerial suspension in a variety of conditions, and inhalation by laboratory animals.

5868 APTIC NUMBER 15744

MacFarlane, Walter and Robert Wright
SOLUBILITY OF VAPOURS IN GASES. J. Chem. Soc., 1934:207-210.

The attraction between methyl alcohol, ether, acetone, or chloroform vapors and carbon dioxide, ammonia, sulfur dioxide, or hydrogen chloride gases was studied at average temperatures and pressures by qualitative and quantitative methods. In the qualitative method, used only for methyl alcohol vapor, equal volumes of a gas and air saturated with vapor were allowed to mix, and after equilibrium had been attained, the change of pressure at constant volume was observed. The results indicate that a considerable attraction exists between hydrogen chloride and methyl alcohol vapors. In the quantitative experiments, liquid was vaporized in a flask containing mercury and gas, after which pressure readings were taken at 15-min intervals for two and one-half hrs. The results were compared by calculating to the common basis of the pressure exerted by 1 mM of vapor in a volume of 100 cc at the temperature of the experiment. The pressures exerted in air are shown to be slightly greater than the theoretical; the pressures exerted in the presence of any other gas are less. In mixtures of hydrogen chloride with methyl alcohol, ether, or acetone vapors, the pressure decreases are marked, indicating considerable attraction between the two constituents of the mixture.

5869 APTIC NUMBER 15082

REINFORCEMENTS: NEW GLASSES, FIBERS DEVELOPED. Mater. Eng., 67(2):40-41, Feb. 1968.

New fibers and reinforcements for use in structural applications are discussed. Boron nitride fibers possess high electrical resistivity, good thermal conductivity, high resistance to self-abrasion and wear, and have high tensile strengths. These fibers, however, are expensive, some are sensitive to water, and others are available only as powders or in limited shapes. Potential applications include ablation shields, space suits, re-entry parachutes, industrial dust collector bags, and high-temperature electrical insulation. A new commercial S-glass is being tested which has a low density, high modulus and strength, and is close to conventional E-glass in price. Whiskers have high tensile strengths and moduli but are exceedingly expensive. High modulus graphite fibers possess a low density, high strength and stiffness, and great resistance to chemical and radiation damage. Potential use is in reinforced epoxy resins and the aircraft industry. Asbestos reinforced plastics have the same increased mechanical properties as the glass fiber and offer low cost. An asbestos-filled nylon is said to be the first non-glass fiber reinforced material that achieves the degree of reinforcement of short glass fiber materials. It allows better bonding, no dilution, and low cost. Potential applications include under-the-hood uses in automobiles, boats, bake ovens, and in the electrical and electronic industries. TFE-fluorocarbons filled with molding grade acetals have the advantages of increased toughness, dimensional stability, increased friction resistance. Their disadvantage is that acetal's stiffness and strength are reduced when blended with virgin acetal to get lower cost material. One use of the material is in the electric knife.

5870 APTIC NUMBER 14798

Matthews, F. J.
CONTROLLING THE LUMINOSITY OF NATURAL GAS FLAMES IN CONVERTED POWER STATIONS. Termotecnica (Milan), 23(8):402-416, 1969. 17 refs. (Presented at the Convention 'I problemi della combustione-Bruciatori', Milan, Italy, June 18-19, 1969.)

An experimental natural gas burner, which produces a stable luminous flame with air velocities similar to those encountered in current oil burners was used to study the influence of various input variables on the flame luminosity, which, together with radiative power, are controlled by rates of soot formation and, to a lesser degree, by burnout. Conditions which favor soot production and hence flame luminosity were established and were found to be in conflict with the conditions necessary for good flame stability in converted front wall burners. A two-stage combustion system is therefore suggested. Some gas should be burnt in a region of low velocity to form a stable pilot flame which will anchor the rest of the flame. The bulk of the gas should then be introduced into the air stream at the same velocity as the air so that a good proportion of it is heated rapidly in the absence of oxygen to produce soot. The practical problems involved in such a system are discussed, and methods of controlling soot burnout by the amount of excess air in the flame or by the temperature of the secondary air, and flame radiation by increasing the initial mixing rates, are considered. The experimental apparatus, methods, and data are given in detail. The experimental burner had a peak total flame emittance of 0.4 from a flame only 510 mm thick. With the same soot concentration in a power station-scale flame about 2 m thick, it is calculated that the total flame emittance, about 0.85, would be comparable with values obtained for oil or pulverized coal flames. Further development of the stabilizer system should permit another increase in scale to a full-size power station burner of about 30 MW (100,000 cu ft/hr).

5871 APTIC NUMBER 14376

McCall, M. G. and P. O. Acheson
RESPIRATORY DISEASE IN INFANCY. J. Chronic Diseases, 21(5):349-359, 1968. 15 refs.

An analysis was made of in-patient hospital morbidity in 1962-64 in the Oxford area of England in an effort to define factors related to the risk of developing respiratory illness in the first three years of life. Data from the Oxford Record Linkage Study were used: information from the babies' birth certificates, hospital discharge summaries (if any), and death certificates (if any), were brought together with information from the mothers' domiciliary or hospital confinement record. A summary punch card was then prepared. Bronchitis was the most common form of respiratory illness requiring hospital admission, followed closely by bronchopneumonia, acute upper respiratory tract infections, and acute bronchitis. Results showed that respiratory diseases remain one of the principal causes of hospital admission and death in infancy. The admission rates due to this group of conditions exhibited a marked seasonal variation in infancy and were high throughout the winter and early spring. The in-patient morbidity from respiratory disease in the first year of life increased in a striking manner with decreasing birthweight. The admission rate for respiratory disease was lowest, 10.4 per 1000 babies, in first children and increased threefold to 33.8 per 1000 babies in children of mothers with 5 or more previous children. The risk of hospital admission for respiratory disease increased with decreasing social class more than the admission rate for all other conditions combined. The risk of hospital admission from respiratory disease was high in infants aged 1 and 2 months and decreased thereafter. In the material under study, urban versus rural residence had no influence on hospital admission rates for respiratory disease or on the seasonal pattern of admissions. The advantages and drawbacks inherent in the type of raw data analyzed are discussed.

5872 APTIC NUMBER 15230

McCartney, J. T. and S. Frown
A MICROSCOPY SYSTEM USING AUTOMATED REFLECTANCE SCANNING TO STUDY COAL APPLICATION TO ANALYSIS OF PYRITE DISTRIBUTION COMPONENTS. Bureau of Mines, Washington, D. C., RI 7256, 15p., May 1969. 13 refs.

An automatic reflectance scanning microscope system was developed for the determination of volume proportions, size

distribution, and mode of association of the physical components of coals. The process, which is potentially more rapid and objective and less tedious than a visual microscopic procedure, involves magnetic tape recording of several millions of reflectance readings on micron-sized areas of polished coal surface and computer analysis and interpretation of some characteristics of the coal components. The automated reflectance scanning microscope system was demonstrated to be an effective system for recording a large number of reflectance measurements on minute areas distributed systematically over a polished surface in a form suitable for subsequent analysis and interpretation by versatile computer programing. The system was tested in a somewhat difficult application involving determination of pyrite distribution in coal. Success in this application was limited, primarily because of difficulties in preparing, by carefully controlled polishing, defect-free areas of characteristic reflectance on the pyrite particles or aggregates. Determination of particle or aggregate size distribution was considerably affected by differences in compactness of the pyrite occurrences in various coals.

5873 APTIC NUMBER 14814

McCartney, J. T., M. J. O'Donnell, and Sabri Ergun
PYRITE SIZE DISTRIBUTION AND COAL-PYRITE PARTICLE ASSOCIATION IN STEAM COALS. CORRELATION WITH PYRITE REMOVAL BY FLOAT-SINK METHODS. Bureau of Mines, Washington, D. C., RI-7231, 18p., Feb. 1969. 18 refs.
PB-183380

In an effort to correlate the size of pyrite particles in coal and coal-particle association with the removal of pyrite before burning, the Bureau of Mines conducted a study of 61 coals presently being used for electric power production. The results were obtained by visual microscopic studies of polished briquets of minus 14-mesh samples. Mean pyrite particle sizes ranged from 20 to 800 microns and proportions of pyrite contained in coal particles to an extent greater than 50% by volume (estimated) ranged from 20 to 95%. These parameters were correlated with reductions in pyrite accomplished by float-sink tests at 1.60 sp gr on 14-mesh, 3/8-inch, and 1.5-inch samples. The correlation coefficients between pyrite removal and mean pyrite particle size were 0.89, 0.88, and 0.79, respectively, for these samples. Correlation coefficients between pyrite removal and coal-pyrite association parameter were 0.92, 0.90, and 0.85, respectively. It is apparent that extent of pyrite removal can be fairly well predicted from microscopic analysis. (Author abstract modified)

5874 APTIC NUMBER 14334

Meakin, John D.
PHYSICAL TECHNIQUES FOR THE CHARACTERIZATION OF SURFACES. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia., Pa., Nov. 1968, p. 53-71. 12 refs.

Physical techniques for determining surface characteristics are described. Two distinct diffraction techniques using electrons were developed, namely Low Energy Electron Diffraction (LEED) and High Energy Electron Diffraction (HEED). The accelerating potential of LEED is in the range of 10-200 volts and 40-100 kilovolts for HEED. In a typical LEED system, a diffraction pattern can be interpreted to determine the spatial arrangement of atoms. A significant number of diffracted electrons suffer inelastic collisions. If the electrons making up the diffraction pattern and the diffuse background can be energy analyzed, there is a possibility of identifying that atom species on the surface. This occurs also in HEED. The atomic scattering factors for HEED are well known and theories which ignore inelastic events give good agreement with experimental results. Theoretical analysis of LEED is more difficult and less developed. Uncertainty exists with regard to atomic scattering factors, inelastic collisions are high, and effects due to multiple scattering or double diffraction are significant. Other high-energy diffraction techniques include the standard electron microscope and the scanning electron microscope. The scanning electron microscope has a small diameter electron beam which is swept across the surface of the sample. The image is generated by either back-scattered electrons or the secondary electrons. The emitted x-rays permit analysis of the elements in the sample surface. Traditional electron microscopy uses two-stage methods which can repeatedly replicate the same region in a non-destructive manner. Field emission techniques are based on effects produced by high electric fields generated near a point of a small radius. If the tip is maintained at a negative potential, electrons are emitted and a field emission image is developed. If the tip is positive and is surrounded with suitable gas, a field ion image is generated. A combination of techniques provides the maximum amount of unambiguous data.

5875 APTIC NUMBER 14748

Mednikov, Ye. P.
THEORY OF ACOUSTIC COAGULATION OF AEROSOLS. (Teoriya Akusticheskov koagulyatsii aerozoley). Text in Russian. Doklady Akad. Nauk SSSR, 183(2):382-385, 1968. 12 refs.

Coagulation of small and large aerosol particles in an acoustic field is given theoretical treatment. Derived expressions for the number of particles as an exponential function of time, the coefficient of acoustic coagulation as a linear function of the oscillation rate of the medium, and the coefficient of acoustic coupling itself are in good agreement with available experimental data.

5876 APTIC NUMBER 15099

Meier zu Koecker, H. and J. Brandt
STUDY OF THE FREEZING-IN TEMPERATURE OF THE SO2/SO3-EQUILIBRIUM IN COMBUSTION GASES OF SULFUR-CONTAINING FUEL OILS. (Zur

Tinfrier-temperatur des SO2/SO3-Gleichgewichtes in Verbrennungsgasen schwefelhaltiger Brennoele). Text in German. Brennstoff-Chem. (Essen), 50(5):139-143, May 1969. 7 refs.

To determine the 'freezing-in' temperature of the SO2/SO3 equilibrium, experiments were conducted in a scaled-down model and in the laboratory. In the first case, a burner installed in an upright steel pipe cooled with water was used. The samples were obtained from the combustion chamber at 500 to 700 C. The SO2 was continuously determined by a modified iodine starch method. For the SO3 analysis, the gas was briefly cooled and passed to a fritted scrubber filled with 80% isoamyl alcohol (pH 3) for absorption. The sulfate which formed was analyzed by titration. Fuel oil with a density of 0.8850 (15 C), a viscosity of 3.7 E, 86.5% C, 12.2% H2, and 1.30% S gas used. Laboratory experiments were conducted with an oil of 85.8% C, 13.0% H2, 0.8% S, a density of 0.8597 (15 C), and a viscosity of 1.62 E. For the SO2 determination in the waste gas, the Woesthoff 'Mikrogas-SO2-E 1' was used. The SO3 was determined by the method developed in the Shell Research laboratories, which is based on condensation. Optimum conditions for the combustion process in the laboratory burner were found at an oil throughput of 0.8 kg/h, an atmospheric pressure of 600 to 600 mm Hg, and an underpressure of 50 mm water in the combustion chamber. The results of the two experiments were in good agreement. The 'freezing-in' temperatures differed on the average by less than 1.5%. The 'freezing-in' temperatures obtained in the laboratory were about 1250 and 1275 K, those obtained in the scaled down model were around 1240 K. The 'freezing-in temperature' was in both cases influenced by the sulfur content of the oil.

5877 APTIC NUMBER 15243

Meijer, R. J.
THE PHILIPS-STIRLING ENGINE. (Der Philips-Stirlingmotor). Text in German. Motortech. Z. (Stuttgart), 29(7):284-298, July 1968. 18 refs.

The development of the Philips-Stirling engine is described and its advantages are enumerated. The engine is based on the principle of moving gas back and forth between a hot chamber and a cold chamber by a displacement piston. Development of the Stirling principle began in 1938 in the Philips research laboratories with the construction of small hot-air engines. Through the invention of the double acting engine, the path to larger Stirling engines was opened. Development of the rhombic gear in 1953 permitted operation with a pressureless crankcase. Hydrogen and helium replaced air. The engine efficiency could be raised to 38%, the specific power to 110 hp referred to the piston displacement volume. Better gaskets improved the longevity of the engine. The problems of thermal tension and heat transfer have been solved. Laboratory models of 10, 40, and 90 hp per cylinder have been built and tested while experiments on a model with 400 hp per cylinder are under way. A Stirling engine performs as well as or even better than a diesel engine. If the Stirling engine is driven with a fossil fuel, the exhaust gases are quite clean. They contain no CO or hydrocarbons owing to a steady combustion in a chamber fenced in by hot walls. Concentrations of NO and NO2 are low. A table comparing the exhaust gas composition of the Stirling engine with a gas turbine indicates this quite clearly. The reason for the reduction in emissions is not fully understood since flame temperatures in the burner are very high. To study the relationship between the temperature of the preheated air and the NOx content, an electrically driven air preheater was installed in a 90 hp one-cylinder engine. It was found that the NOx content decreases with decreasing temperature of the preheated air. If part of the exhaust gas is returned to the combustion air, the NO content can be further reduced.

5878 APTIC NUMBER 15186

Michaels, Alan S., Raymond P. Baddour, Harris J. Bixler, and C. Y. Choo
CONDITIONED POLYETHYLENE AS A PERMSELECTIVE MEMBRANE. Ind. Eng. Chem. Process Design Develop., 1(1):14-25, Jan. 1962. 16 refs.

The purposes of the investigation were (1) to measure the rates of transmission of xylene isomers through conventional polyethylene films under controlled conditions; (2) to condition polyethylene films by heating the polymer in the presence of selected isomers, followed by cooling; and (3) by measuring the isomer transmission characteristics of the conditioned films, to establish whether the conditioning process has any significant effect on either film permeability or permselectivity to the isomers. By swelling polyethylene film in p-xylene and annealing the film at an elevated temperature in the swollen state, it was possible to increase the xylene liquid permeation rate through the film and the permselectivity of the film to p- with respect to m- and o-xylenes. Permeability and permselectivity changes are highly dependent on the degree of swelling, the treatment temperature, polymer crystallinity, and the treating compound. Alteration of the crystalline texture of the polymer is believed responsible for the observed effects. This technique of tailoring a polymeric membrane to render it more effective as a separation barrier appears to open new prospects for the utilization of membrane permeation as a practical mixture separation method.

5879 APTIC NUMBER 15104

Michaels, Alan S., Wolf R. Vieth, and James A. Barrie
DIFFUSION OF GASES IN POLYETHYLENE TEREPHTHALATE. J. Appl. Phys., 34(1):13-20, Jan. 1963. 16 refs.

Diffusion of helium, oxygen, nitrogen, argon, carbon dioxide, and methane in glassy and rubbery polyethylene terephthalate was studied in the range of 25 to 130 C. Despite the abnormal solution behavior of these gases in the glassy polymer, the diffusion process is evidently normal and Fickian. Correlation of solubility constants for oxygen and nitrogen, obtained by the time-lag method, with data obtained by a static sorption method, indicates that glassy crystalline polyethylene terephthalate may be considered an isotropic diffusion medium. Diffusion is impeded purely geometrically by the presence of the crystallites, and the impedance factor is equal to the reciprocal of the amorphous volume fraction. In the rubbery crystalline state of the polymer, diffusion is Fickian and apparent activation energies for diffusion are larger than those in the glassy

crystalline polymer. A model for diffusion in the glassy amorphous and crystalline polymers is proposed, assuming that the driving force for diffusion is the concentration gradient of dissolved molecules which are assumed to be in local equilibrium with molecules in the 'holes.' The model predicts that actual diffusion constants and activation energies are larger than those experimentally measured. Thus, part of the observed difference between values of the activation energy in the glassy and rubbery states may be reconciled. Correlations of diffusion and activation energy with the square of gas molecular diameters are obtained in both the glassy and rubbery states. In the latter plots, the helium data fall above the correlations, showing evidence of partially nonactivated diffusion in both states of the polymer. (Author abstract modified)

5880 APTIC NUMBER 15265

Michaels, Alan S. and Harris J. Bixler
FLOW OF GASES THROUGH POLYETHYLENE. J. Polymer Sci., 50(154):413-439, 1961. 17 refs.

Diffusion and permeability constants for twelve permanent gases were measured in a linear and a branched polyethylene, hydrogenated polybutadiene, and natural rubber from 5-55 C. The time-lag method was used in the determinations. For all gas-polymer pairs investigated, a linear plot of the logarithm of the diffusion or permeability constants s the reciprocal absolute temperature exists, indicating the occurrence of activated diffusion. Arguments are presented supporting the hypothesis that natural rubber is a completely amorphous analog of polyethylene with respect to the diffusion process. The reduction in diffusion constants is to quantitatively express in going from natural rubber to hydrogenated polybutadiene (29% crystalline), to the branched polyethylene (43% crystalline), and to the linear polyethylene (77% crystalline). These reductions were strongly dependent on gas molecular size, increasing as the molecular size increases. A geometric impedance factor and a chain immobilization factor are introduced to account for the effect of crystallinity. The former is assumed to be independent of molecular size; it explains the necessity of the diffusing molecule to bypass crystallites which are shown to be impenetrable. The latter size-dependent factor reflects the reduction in amorphous chain segment mobility brought about through the proximity of crystallites. Analysis of the geometric impedance factor supports the existence of thin, highly anisometric sheets of crystalline polymer in polyethylene. The anisometry of the crystallites increases with increasing crystallinity consistent with the chain folding mechanism for crystal growth in polyethylene. Nucleation and growth kinetics also account for the variation in crystal anisometry observed in polymers prepared by different methods of polymerization. The apparent activation energies for diffusion determined in polyethylene include not only the energy required for chain segment separation, but also the effect of thermal expansion and crystalline melting. Correlations are presented which permit the estimation of gas diffusion constants in a wide variety of polyethylenes. (Author summary modified)

5881 APTIC NUMBER 15165

Michaels, Alan S., Harris J. Bixler, and Harvey L. Fein
GAS TRANSPORT IN THERMALLY CONDITIONED LINEAR POLYETHYLENE. J. Appl. Physics, 35(11):3165-3178, Nov. 1964. 18 refs.

The sorption and diffusion of helium, argon, and ethane, and their temperature dependencies were measured in a series of linear polyethylene films previously subjected to widely differing conditions of cooling from the melt and to subsequent annealing at elevated temperature. The results indicate unexpected effects of thermal history on crystalline morphology. Rapidly cooled polymer, after annealing at 130 C, exhibited significantly higher permeability to all gases than slowly cooled polymer, suggesting that gas permeability of linear polyethylene is not uniquely determined by level of crystallinity, but depends also on the path by which such crystallinity is developed. Irrespective of thermal history and crystallinity level, solubility constants and heats of solution of argon and ethane were normal, varying linearly with amorphous volume fraction. Diffusion activation energies for these gases were also independent of thermal history. The solubility constants of helium were anomalously high, and dependent on both thermal history and level of crystallinity. With helium, anomalous temperature variations of diffusion constants were observed with films in which solubility was anomalous. The peculiar sorption and diffusion behavior of helium implies that helium is capable of slow diffusion into, and occupancy of, defects or voids within the crystalline structure from which larger gas molecules are excluded. The 'chain immobilization factors' for argon and ethane are thought to be a size-controlled impedance to diffusion. They arise from the extremely small dimensions of the diffusional paths in highly crystalline polymer.

5882 APTIC NUMBER 15143

Michaels, Alan S. and Harris J. Bixler
SOLUBILITY OF GASES IN POLYETHYLENE. J. Polymer Sci., 50(158): 393-412, 1961. 22 refs.

The solubility constants for thirteen permanent gases were measured from the 5-55 C in a linear and branched polyethylene, hydrogenated polybutadiene, and natural rubber. Equilibrium and time lag solubility determinations were made and were in agreement. The solubility of each gas in polyethylene was proportional to the volume fraction of amorphous material when the polymer was treated as a simple, two-phase mixture of crystalline and amorphous polymer, each with a characteristic specific volume. A solubility constant in completely amorphous polyethylene was determined for each gas which, with the density of an arbitrary sample, enabled calculation of the solubility of each gas in that particular sample. A correlation of the solubility constants in completely amorphous polyethylene was obtained from a thermodynamic model of the dissolution process. The solubility constants in natural rubber, a completely amorphous polymer under the experimental conditions, were approximately 50% higher than those in amorphous polyethylene. Higher intermolecular forces due to the unsaturation in natural

rubber may account for this result. The apparent heats of solution of all gases in branched polyethylene were approximately 1.0 kcal/g mole more positive than those in linear polyethylene. This behavior was the result of crystalline melt-out in branched polyethylene. In linear polyethylene the experimental solubility data yielded essentially true heats of solution, since negligible crystalline melt-out occurred between 5 and 55 C. These were correlated by the thermodynamic model for the dissolution process. Available evidence indicates that the crystallites in polyethylene are impenetrable, and are randomly distributed on a macroscopic scale with respect to the diffusion and dissolution processes. The amorphous phase behaves as a homogeneous liquid whose thermodynamic properties are independent of the mode of polymer preparation, thermal history of the sample, and level of crystallinity. (Author summary modified)

5883 APTIC NUMBER 15183

Michaels, Alan S., Wolf P. Vieth, and James A. Barrie
SOLUTION OF GASES IN POLYETHYLENE TEREPHTHALATE. J. Appl. Phys., 34(1):1-12, Jan. 1963. 19 refs.

The solubilities of helium, nitrogen, oxygen, argon, methane, carbon dioxide, and ethane in glassy amorphous and crystalline polyethylene terephthalate were studied by time-lag and/or static sorption methods. Solubilities of all the gases but ethane were also determined in the rubbery crystalline polymer. The only deviations from Henry's law were displayed by ethane at 25 C and carbon dioxide at 25 and 40 C in the glassy polymer. Correlation of solubility constants for oxygen and nitrogen obtained by the static sorption method with values obtained dynamically indicate that the glassy crystalline polymer is an isotropic diffusion medium. Sorption in the glassy amorphous and crystalline polymers generally takes place by two processes operating concurrently: ordinary dissolution plus 'hole-filling.' Crystallinity reduces gas solubility in the glassy polymer, but not generally in direct proportion to the decrease in amorphous volume. An exception is helium. The glassy state of the partially crystalline polymer extends to about 80-85 C where a transition region is noted on a van't Hoff plot for solubility constants. The other extremity of this region (about 95 C) marks the onset of rubber-like behavior in the polymer. Heats of sorption in the glassy crystalline polymer are more exothermic than in the rubbery crystalline polymer, characteristic of the transition from sorption by dissolution and void-filling processes to dissolution alone. The heat of solution of helium is slightly positive in both the glassy and rubbery states of the crystalline polymer. It appears that the major contribution to helium sorption in either state of the crystalline polymer is ordinary dissolution. In both the glassy and rubbery states, carbon dioxide shows evidence of a polar interaction with the polymer. Solubility constants are correlated with gas force constants in both the glassy amorphous and rubbery crystalline polymers. (Author abstract modified)

5884 APTIC NUMBER 13528

Michailova, V. A.
THE KINETICS OF THE REACTION BETWEEN AMMONIA AND NITRIC OXIDE ON THE SURFACE OF A PLATINUM FILAMENT. Acta Physicochim. USSR, 10(5):653-676, 1939. 16 refs.

Ammonia and nitric oxide were circulated in a closed system at pressures close to 2 cm Hg at 500-530 K. At higher temperatures, self-heating of the platinum wire occurred. Water formed during the reaction was absorbed with potassium hydroxide and partially frozen out with dry ice. The data obtained on kinetics led to the following hypothesis for the reaction mechanism: both reacting gases are well adsorbed on a platinum surface free from adsorbed oxygen; the reaction proceeds between the molecules adsorbed on neighboring elementary spaces, while the reaction products (nitrogen and water) are not adsorbed. The reaction velocity is independent of the pressures of each gas but dependent on the ratio of the pressures. It reaches a maximum at a definite ratio of the pressures of both gases. With equivalent amounts of the gases present, it is constant for the first 50 min. The apparent activation energy for the reaction is 24.8 Kg cal.

5885 APTIC NUMBER 13310

Michell, R. H., J. L. Harwood, P. Coleman, and J. N. Hawthorne
CHARACTERISTICS OF RAT LIVER PHOSPHATIDYLINOSITOL KINASE AND ITS PRESENCE IN THE PLASMA MEMBRANE. Biochim. Biophys. Acta, 144(3): 649-658, Dec. 1967. 39 refs.

A comparison of the phosphatidylinositol kinase of rat liver with the same enzyme of the brain showed a number of similarities. Both enzymes may be activated by Mg(2 plus) or Mn(2 plus), but not by Ca(2 plus), and both appear to catalyze the reaction: phosphatidylinositol plus ATP yields diphosphoinositide plus ADP. The subcellular distribution of the liver enzyme does not parallel that of nuclei, mitochondria, lysosomes, or endoplasmic reticulum. It was found that the activity of the kinase is at least twice as high in purified plasma membranes as in nuclei prepared from the same crude nuclear fraction. The The role of phosphatidylinositol kinase at the cell surface is also discussed. (Author abstract modified)

5886 APTIC NUMBER 15225

Miescher, E.
ANALYSIS OF THE SPECTRUM OF THE NITRIC OXIDE MOLECULE. (Basel Univ. (Switzerland), Dept. of Physics, Grant AF-EOAR-65-74, AFCRL-69-0268, 9p., April 15, 1969. 17 refs.
DDC: AD 689 398

The vacuum-ultraviolet absorption spectrum of four different isotopes of nitric oxide gas was photographed with the most powerful existing spectrographs. The infrared and the visible emission spectrum emanating from a discharge through rapidly streaming NO also was recorded with very large instruments. In the vacuum-ultraviolet, it was photographed with a 1 meter grating. Comprehensive rotational analyses of the many band structures observed on the plates were carried out. The result of the investigation is the knowledge of the excited states of

the NO molecule exceeding the present knowledge for any other molecule as far as completeness and theoretical understanding is concerned. Several novel features in band structures could be studied, particularly electronic interactions and extreme Rydberg state uncoupling. Important molecular constants could be derived with high accuracy. (Author abstract modified)

5887 APTIC NUMBER 15127

Mikhailova, Yu. V. and L. A. Maksimov
EFFECT OF ELECTRIC FIELD ON THE TRANSPORT COEFFICIENTS OF POLAR GASES. Soviet Phys. JETP (English translation from Russian of: Zh. Eksperim. i Teor. Fiz.), 28(6):1265-1271, June 1967. 11 refs.

A solution is presented for a kinetic equation for a gas of polar molecules of the symmetric-top type or of diatomic polar molecules in the presence of a constant electric field. The heat conduction and viscosity tensors are determined. It is shown that in polar gases the invariance of the collision operator relative to time reversal makes it possible for the perturbed distribution function to possess terms with any parity relative to the velocity. As a result, the following effect can be observed in an electric field: by creating a temperature gradient, one can obtain a change of the viscosity tensor.

5888 APTIC NUMBER 15128

Miller, S. A. and J. S. Carter
HOW PROCESS VARIABLES AFFECT FILAMENT WOUND PLASTICS. PART 3. Mater. Design Eng., 52(2):144-146, Aug. 1960.

The effects of winding tension, roving end count, and resin content of mechanical properties of filament wound polyester structures were determined. Winding tension indirectly affects to some extent pin shear, bearing, and interlaminar shear strength; it does not affect panel shear strength. The resin content as affected by winding tension appears to have more influence than the degree of tension itself. The process variables introduced by altering end count, such as handling characteristics, winding speed, and tension uniformity, appear to have greater influence on mechanical properties than the number of ends itself. From the data obtained, it is concluded that as long as the same primary construction is maintained and process variables are held constant, the end count used will have no effect on mechanical properties. Initial resin content in the roving has no effect on physical properties of the finished laminate, since the final resin content is essentially the same under equal tensioning. However, void content is markedly reduced by increasing initial resin content. Measurements of weight loss caused by high temperature aging of wound polyester structures were also made. At 400 F weight loss was negligible. At 500 F weight loss increased but after 200 hr was still only 7% of original resin weight. At 550 F weight loss was considerable. A structure probably could not maintain its integrity under load after 300 hr at 550 F.

5889 APTIC NUMBER 15258

Minck, R. W. and W. G. Rado
INVESTIGATION OF OPTICAL BREAKDOWN PHENOMENA. In: Physics of Quantum Electronics. P. L. Kelley, B. Lax, and P. E. Tannenwald (eds.), New York, McGraw-Hill, 1966, p. 527-537. 13 refs.

A pulsed ruby laser was used to measure the pressure dependence of threshold power for nitrogen and argon at 0.1 to 100 atm pressure, and to determine the electron intensity of the laser-induced spark. The measured variation of threshold with focal diameter from 5 to 50 microns in both argon and nitrogen at 100 atm implies that diffusion effects can influence the discharge of gases in a sharply focused laser beam. Curves obtained by plotting atm pressure against relative threshold power show that threshold levels decrease with increasing pressure over most of the measured pressure range. However, the curves indicate a leveling off and then an upturn at high pressures. The observed pressure dependencies of threshold at low to medium pressure agree better with predictions based on time-limited breakdown than on attachment-limited breakdown, but the variation between time-limited and diffusion-limited breakdowns is small. The angular dependence of light scattered to 90 deg from a spark at 1 atm has a pronounced forward component. The forward scattering remains constant as pressure increases, but backward scattering increases drastically.

5890 APTIC NUMBER 15217

Miyamoto, Terumasa, Shiro Oshima, Katsuyuki Mizuno, Manabu Sasa, and Tatsushi Ishizaki
CROSS-ANTIGENICITY AMONG SIX SPECIES OF DUST MITES AND HOUSE DUST ANTIGENS. J. Allergy, 44(4):228-238, Oct. 1969. 12 refs.

Body and excreta of Dermatophagoides farinae were found to be an important allergen in house dust. However, house dust contained more than 35 species of mites. The major mites in house dust are Glycyphaginae and D. pteronyssinus, which make up 31.8% and 27.2%, respectively; D. farinae comprises only 8%. Consequently, antigenic relationships between house dust and six species of mites, including D. farinae, were studied by skin testing and the in vitro neutralization of skin-sensitizing antibody. It was found that D. farinae was most closely related to house dust antigen in comparison with five other species of mites: Chortoglyphus arcuatus, Blomia sp., Aleuroglyphus ovatus, Suidasia nesbitti, and Tyrophagus putrescentiae. Cross-antigenicity was found among these mites, although this was not complete, and it was considered that each species of mite had its own characteristic antigen. Moreover, the antigenicity of D. farinae was quite potent, and D. farinae appeared to possess the major common antigen among these species of mites. Therefore, the existence of identical antigenicity between house dust and D. farinae was not surprising even though D. farinae constituted only a few per cent of the mites. D. farinae and C. arcuatus were more potent in skin reactivity in comparison with other species of mites, but cross-antigenicity between these two species was not as close as that between the other species. The bodies of mites had identical antigenicity with the excreta.

5891 APTIC NUMBER 15189

Mizushina, Tokuro, Hirovuki Ueda, Shinichiro Ikeno, and Ko Yshii
SIMPLIFIED CALCULATION FOR COOLER CONDENSERS FOR GAS-MULTICOMPONENT VAPOR MIXTURES. Intern. J. Heat Mass Transfer, 7(1):95-100, Jan. 1964. 10 refs.

The 'three points method', a simplified calculation for cooler condensers, is applied to the system of gas-multicomponent vapor. The gas rate, the vapor concentrations and the gas temperature at the inlet, the percentage of moles of vapor to be condensed, and the temperature of cooling water available are used in calculations. Assuming that the outlet gas mixtures are in equilibrium with the liquid of the concentration of the vapor component ratio in the inlet gas mixture, and calculating the total vapor pressure, the temperature and the partial pressure of each vapor component are determined. The total heat transferred, the rate, and the outlet temperature of the cooling water are determined from the total heat balance. A fictitious middle point, where the gas temperature, the rate of each vapor component, and the cooling water temperature are the arithmetic mean of those at the gas inlet and outlet, is assumed. The heat balances are applied to the three points, i.e., inlet, middle, and outlet to calculate the temperatures at the interface between condensate film and gas at those points. This method gives satisfactory accuracy for design purposes in a short time computation. Instead of the middle point, a one-thirds and two-thirds point may be assumed. This 'four points method' may be better than the three points method.

5892 APTIC NUMBER 15833

THE SEPARATION OF GASES AT STOKE-ON-TRENT. THE GROWING IMPORTANCE OF CRYOGENIC ENGINEERING. Mod. Refrig. Air Control, 66(789):1124-1127, Dec. 1963.

An air separation plant at Stoke-on-Trent is designed to produce 200 tons of oxygen a day. This can be all gaseous oxygen (GOX) or 60 tons of liquid oxygen (LOX) and 140 tons of gas. About 50 tons of liquid nitrogen (LYN) and 8 tons of argon can be produced each 24 hours day in place of the LOX. The incoming air (1000 tons a day at rated output) is raised to 6 atm pressure and passed through a condensate separator, the major proportion proceeding to regenerate heat exchangers. The rest of the air is boosted to 200 atm pressure. The air passes through a pair of activated alumina driers after a pre-cooler operated from the 'Freon' system. After a first-stage cooling in the main heat exchangers, the high-pressure air is cooled to -78 deg C by the 'Freon' unit. After a pass through the heat exchanger (which carries three distinct streams - air and oxygen counter-current in tubes, with nitrogen on the shell side), the air goes through an expansion valve, then through a pair of silica gel carbon dioxide absorbers, back to the exchanger for another pass, and finally through another expansion valve which brings the pressure down to that of the low-pressure air. The low-pressure air enters the regenerative heat exchangers which also act as driers and a carbon dioxide removal system. After leaving the regenerators, the low pressure air joins the high-pressure stream, now at the same pressure after passing through the last expansion valve, and the combined stream of vapor and liquid passes to the distillation column. The air separates into a crude oxygen-rich liquid at the bottom and a gaseous nitrogen product at the top. After passing through an expansion valve, the crude LOX enters the upper column via another sub-cooler. In the reboiler-condenser, pure LOX from the upper column condenses gaseous nitrogen from the top of the lower column. Pure gaseous nitrogen from the top of the upper column then leaves the plant. Argon is separated in the side-arm column where it is stripped from argon-rich oxygen, resulting in a product containing about 90% argon.

5893 APTIC NUMBER 15196

Moeller, G. and J. Dane Rigden
OBSERVATION OF LASER ACTION IN THE P-BRANCH OF CO2 AND N2O VIBRATIONAL SPECTRA. Appl. Phys. Letters, 8(3):69-70, Feb. 1, 1966. 8 refs.

By using a diffraction grating as the reflecting element at one end of a laser cavity, oscillations were obtained for 170 lines in P and R branches of the following bands: 00(zero-th angular momentus state)1-10(zero-th ams)0, and 00(zero-th ams)1-02(zero-th ams)0 vibrational bands of CO2; and the 00(zero-th ams) 1-10(zero-th ams)0 bands of N2O. Laser action reached J values over 50 in some cases. Of the total number of lines, 103 are in CO2. As the grating rotates to make the laser cavity resonant at different wavelengths, the emission spectrum of each line is recorded. The laser admission is confined to narrow frequency ranges near the center of each peak and the apparent width of emission lines is caused by lack of resolution in the grating mirror, but no attempt was made to utilize the full width of the grating to attain the maximum resolution. This can be accomplished by placing the grating at some distance from the active plasma. The emission spectra were obtained by existing only 2 m of the 6 m-long laser tube. It is assumed that the grating device can be applied to a study of other high-grain infrared bands.

5894 APTIC NUMBER 15220

Monchik, L., K. S. Yun, and E. A. Mason
FORMAL KINETIC THEORY OF TRANSPORT PHENOMENA IN POLYATOMIC GAS MIXTURES. J. Chem. Phys., 39(3):654-669, Aug. 1, 1963. 40 refs.

A rigorous formal kinetic theory of multicomponent polyatomic gas mixtures is derived. The methods are essentially a combination of those used by Chapman and Enskog for monatomic gases (as extended to multicomponent mixtures by Curtiss and Hirschfelder), and those used by Wang Chang and Uhlenbeck for a single polyatomic gas for the case where the equilibration between internal and translational degrees of freedom is easy. The calculations correspond to the first approximation in the classical Chapman-Enskog theory. Expressions are derived for the coefficients of shear viscosity, volume viscosity (which is proportional to a relaxation time), ordinary diffusion, translational and internal thermal conductivity, and thermal

diffusion. Although the results are rather formal, a number of useful conclusions about the effects of inelastic collisions can be drawn without the necessity of detailed calculations. For instance, it is comparatively simple to show that inelastic collisions have very little effect on shear viscosity and ordinary diffusion, but probably seriously affect thermal conductivity and thermal diffusion. The Hirschfelder-Eucken formula for the thermal conductivity of polyatomic gas mixtures appears as a limiting case of the present formulas. A number of other conclusions and implications of the present formulas are also discussed. (Author abstract)

5895 APTIC NUMBER 15018

Norgin, W. H.
RECIPROCATING EXPANSION ENGINE IS USED FOR GENERATING VERY COLD TEMPERATURES. Iron Steel Engr., 35(6):130, 136, 139, June 1958.

Process demands for cooling gases to temperatures (-)100 F and below are efficiently handled by a reciprocating expansion engine. When properly applied, its thermal efficiency is 75-85%. Designed to develop temperatures as low as (-)300 F, the expansion engine meets many of the requirements in the cryogenic field. The amount of cooling obtainable from a reciprocating expansion engine depends on several factors. These are the displacement per minute, inlet conditions, pressure ratio through the expander, and the characteristic of the gas passing through the expansion cycle. The reciprocating expander engine is not designed to handle liquids. The unit should not be used where condensates are formed. One of the more common hazards arises from the fact that most commercial gases contain some impurities which, on expansion, tend to solidify as fine, abrasive particles in the cylinder. Such particles shorten the life of the cylinder and rings. The expansion engine is no substitute for a rectifying column. The only possible separation that could take place in the engine occurs when a mixture of two gases with widely different boiling points is expanded. The gas mixture can be expanded in the engine to some selected pressure where liquefaction is about to occur or the expansion engine can be used to ready the product for liquefaction. A useful application of the expander engine is in producing refrigeration for large vessels in which physical or chemical processes are being carried out at low temperatures, or simply to cool storage vessels containing liquified gases to prevent excessive evaporation. It is also mentioned that in handling gas mixtures in the expander engine directly, the final condition is frequently indeterminate.

5896 APTIC NUMBER 15059

Morozov, D. M., B. N. Makov, M. S. Ioffe, B. G. Brezhnev, and G. M. Pradkin
AN ION SOURCE FOR STABLE ISOTOPE SEPARATION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:447-449. 2 refs.

A maximum productive ion source for an electromagnetic separator was created. The electromagnetic separation method used is the one where the ion source is fed with high voltage to accelerate the ions. The high voltage lead-in was developed in the inital stage of creating the source. The gas discharge head and the system of accelerating the electrodes were subjected to some alterations because of the growing requirement of raising source productivity as well as in connection with passing over to isotope separation of other elements. The ion source which was developed is a multirate device with interchangeable parts. After each cycle of several day's interrupted work, it is dismantled for a cathode substitution and a re-charge of the working material as well as for cleansing. The high voltage lead-in braces the gas discharge head and the accelerating electrode system and also conducts electricity and cools water. A non-independent discharge was selected with an incandescent cathode in the longitudinal magnetic field of the separator. The best method of supplying the working material into the discharge proved to be equal vapor distribution along the whole of the discharge chamber height. Constant cathode electronic emission was achieved by incorporating the indirect heated cathode and the creation of an electric circuit for automatic arc current and voltage stabilization. Accelerator electrodes were positioned to create an electric field for the extraction and acceleration of ions formed in the discharge chamber. For improving the shape of the ion beam on the ion receiver in the presence of the nonaberration magnetic field, the ion beam is focused vertically by curving all the electrodes along the vertical plane. The power supply consists of five independent circuits, the controls of which are concentrated on one panel.

5897 APTIC NUMBER 14591

Morrison, J. M. and M. P. Weir
HEAT-SENSITIVE DEOXYRIBONUCLEASE ACTIVITY IN CELLS INFECTED WITH HERPES SIMPLEX VIRUS. Biochem. J., Vol. 98, p. 37C-39C, 1966. 7 refs.

The activity of deoxyribonuclease from mammalian cells grown in tissue culture increases markedly after infection of the cells with herpes simplex virus. Heat-inactivation experiments, response to Na(+) and K(+), pH optimum, and bivalent cation requirements indicated that the infected cells contain deoxyribonuclease activity that is not present in the uninfected control cells. There is, however, no clear indication whether production of the enzyme(s) is programmed by the viral or by the host-cell DNA. This point could be determined only by in vitro syntheses of enzyme directed by the respective DNA.

5898 APTIC NUMBER 15166

Moruzzi, J. L., J. W. Ekin, Jr., and A. V. Phelps
ELECTRON PRODUCTION BY ASSOCIATIVE DETACHMENT OF O(-) IONS WITH NO, CO, AND H2. J. Chem. Phys., 48(7):3070-3076, April 1, 1968. 26 refs.

Electron currents produced in associative detachment reactions involving O(-) ions were detected and measured in an electron drift tube. The reactions studied were those between O(-) and NO,

O(-) and CO, and O(-) and N2. The associative-detachment rate coefficients were obtained from analyses of the electron current waveforms. The results indicate that the associative detachment proceeds by a two-body process. The observed rate coefficients are consistent with results obtained from studies of O(-) destruction using mass spectrometric techniques. Associative detachment rate coefficients of 2.2, 6.5, and 7.5 times 10 to the minus 10th power cu cm/sec were measured at near-thermal ion energies for the O(-) plus NO, O(-) plus CO, and the O(-) plus N2 reactions, respectively. The average energy of the O(-) ions ranged from thermal up to 0.16 eV. A search for a reaction between O2(-) and CO was unsuccessful, indicating that the rate coefficient of this reaction is less than 10 to the minus 14th power cu cm/sec. (Author abstract modified)

5899 APTIC NUMBER 15209

Mullaney, P. F. and P. W. Dean
CELL SIZING: A SMALL-ANGLE LIGHT-SCATTERING METHOD FOR SIZING PARTICLES OF LOW RELATIVE REFRACTIVE INDEX. Appl. Opt., 8(11):2361-2362, Nov. 1969. 11 refs.

Light-scattering experiments were conducted with biological cells suspended in normal saline using a helium-neon laser. The small cross section diameter and narrow divergence of the beam allowed routine scattering measurements to be made at angles as small as 0.5 degrees. The intensity ratio was calculated according to the Mie theory computer codes DAMIP and DMATP for m (the refractive index of the particle with respect to the surrounding medium) equal to 1.2, 1.1, 1.04, and theta (the angle) equal to 0.5 and 2.0 degrees. These values of m are close to those for plastic microspheres, several spores, and biological cells immersed in water. Results of the Mie and diffraction calculations were compared and agreement was good. Since the diffraction and Mie methods agree quite well even for small m, it suggests that this type of scattering measurement could yield information on particle size and be relatively independent of the effects of transmitted light. The apparent insensitivity of m would allow calibration with any convenient particles, opaque or transparent, without knowledge of the refractive index. The analysis suggested that the ratio of intensities method is an attractive means of obtaining absolute size.

5900 APTIC NUMBER 14983

Murray, James A., Theron S. Brown, and Frank F. Webster
FP TRACER CO-DISPERSAL AND SAMPLING STUDIES. Metronics Associates, Inc., Palo Alto, Calif., Contract DA-42-007-AMC-280(F), Proj. TV 025001A128, TR 135, 176p., Dec. 1968. 15 refs.
DDC: AD 682 012

The effect of co-dispersal of fluorescent particles (FP) with other materials and tracers was investigated, improvement of the representation of the efficiencies of co-dispersal dissemination and the air sampling systems was undertaken. Co-dispersal studies of FP 2267-Yellow and FP 3206-Green with other fluorescent tracers of various sizes, densities and colors were performed using the high-speed centrifugal blower as a dissemination device. FP aerosol clouds comprising up to four different fluorescent colors were generated, sampled and assessed. The reproducibility and limitations of co-dispersal results, the blower co-dispersal efficiency, and new co-dispersal applications are described. The sampling performance of the membrane filter (MF) sampler is investigated. The effect of MF sampler orientation on the magnitude of measured FP total dosages, the adequacy of the MF sampler for employment as a field or reference standard sampler, and the performance of the MF sampler in collecting new tracer materials is discussed. Collection efficiency of a Rotorod sampler was measured using standard procedures. Collection efficiency was also determined using modified collector shapes and coating procedures which were developed to enhance the assessability of Rotorod FP collectors. Measurements of collection efficiencies were obtained for FP materials with an intrinsic density of about 1.5 g/cc and with diameters as large as 30 microns. Sampling studies were conducted with the 6-second and 30-second Drum Pulsed Sequential (DPS) FP sampler. Average concentrations or partial dosages for periods as short as 6 seconds were measured to obtain the time dependent FP cloud characteristics. The sampling efficiency of the DPS units averaged about 90%. (Author abstract modified)

5901 APTIC NUMBER 14501

Nagata, M., T. Tuji, S. Sasaki, T. Shiozaki, and I. Ogiwara
EVALUATION OF PULMONARY VENTILATORY FUNCTIONS OF SCHOOL CHILDREN, AGED 6-15, IN A RURAL AREA OF GUNMA PREFECTURE. (Gunma-kenka ichi no son sho chu gakusei no hai kanki kino kensa seiseki no hyoka). Text in Japanese. Nippon Piseigaku Zasshi (Japan J. Hyg.), 24(1):93, April 1969.

Studies of pulmonary ventilatory functions (i.e., vital capacity (VC) and timed vital capacity) were done on 1002 school children, aged 6 to 15, in the rural area where there would be seemingly no air pollution. A 'Vitalor' and a Wright peak flow meter were used. The ratio of actual VC to VC predicted by Kanagami's equation suddenly drops for children 14 to 15 years old. According to Miller's classification of lesions, children with defective ventilatory function show the first symptoms at this age. When the height and weight of the subjects were compared with the growth percentile calculated from the Ministry of Education statistics, it was seen that there are more children whose physical growth conditions (P) is less than P25 for this age group. There was an abnormally high rate of appearance of defective ventilatory function in the group below P25. The same examination procedure for the same subjects given a year later showed that some children with abnormal ventilatory function had reverted to normal and their physical growth had risen above P25. It was concluded that the equation for prediction of pulmonary function is not always useful for children whose physical growth is below P25.

5902 APTIC NUMBER 15756

Navalles, Henri, Gerard Porthe, and Michel Destriau
REACTION OF OXYGEN WITH NITROUS OXIDE. (La reaction de l'oxygene

avec l'oxyde azoteaux). Text in French. Bull. Soc. Chim. France, no. 9:3088, 1969. 8 refs.

A study of the chemiluminescence that occurs when nitrous oxide and hydrogen react at temperatures and pressures of 726 C and 300 mm Hg and 820 C and 600 mm Hg, refutes the hypothesis that in the following sequence of reactions, the last two are of little significance: N2O + M2O yields N2 + O + M2O; O + H2 yields OH + H; O + N2O yields 2 NO; and O + NO yields NO2 yields NO2 + hv. It is concluded that it would be difficult to account for the luminous emission if the last reaction does not take place.

5903 APTIC NUMBER 14712

Nelson, G. O.
A SIMPLIFIED METHOD FOR GENERATING KNOWN CONCENTRATIONS OF MERCURY VAPOR IN AIR. In: Hazards Control Progress Report No. 33 (January-April 1969), California Univ., Livermore, Lawrence Radiation Lab., UCRL-50007-69-1, p. 35-38, 1969.

A compact apparatus which would require a minimum of specialized equipment but which would still provide a desirable accuracy for the production of mercury vapor in air was designed. The compressed air passes through indicating silica gel, soda lime, and a charcoal filter to remove any impurities. The purified air stream splits into two lines; one line is used as the dilution air and the other flows into a saturation unit. The saturated and diluted air are mixed. The desired concentration is achieved by adjusting the flow rates of air and mercury-saturated air at the measurement temperature. Accurate measurement of the temperature is the most crucial part of the calibration operation. The mercury vapor generator occupies only about 1 sq ft of bench space and yields concentrations from 0.011 to 2.5 mg/cu m at flow rates of 6 l/min or more. Other concentration ranges can be achieved if different flowmeters are substituted for those suggested. Concentration changes are made simply and easily by adjusting the needle valves. Equilibrium is reached almost instantaneously, since there is no large mixing flask to equilibrate.

5904 APTIC NUMBER 14688

Wiedrach, L. W.
ELECTROCATALYSIS AND RELATED PROCESSES AT THE HYDROCARBON ANODE. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia., Pa., Nov. 1968, p. 487-524. 33 refs.

Several techniques were used to study oxidation reactions occurring at the hydrocarbon anode of low-temperature fuel cells using aqueous acidic electrolytes. They have provided information about surface species and reaction kinetics. Results indicate two major paths for such oxidations, both deriving the required oxygen from water in the electrolyte. The first, and preferred, path involves fission of carbon-carbon bonds to form Cl radicals. These rapidly react with water to form a partially oxygenated surface intermediate which in turn reacts further at moderate overvoltage to form CO2. The second path results in the formation of more refractory multi-carbon alkyl radicals on the surface. They are held to the surface by multipoint attachment and are more difficult to oxidize. Because of the many species present on the electrode surface and changes in coverage and composition with temperature, potential, and time, a study of the anodic oxidation of hydrocarbons requires many transient electrical measurements. Some of the techniques used in measurement may prove useful in connection with air pollution and abatement problems. (Author summary modified)

5905 APTIC NUMBER 14401

Nielsen, Klaus W. and Edwin Y. Berry
DEVELOPMENT AND USE OF AN AIRBORNE AIR MARKER FOR ATMOSPHERIC RESEARCH. J. Appl. Meteorol., 8(4):502-505, Aug. 1969. 7 refs.

A simple air marking technique was devised. A reservoir and pump were installed behind the forward seats of a Cessna 206 seeding aircraft. This location permits operation of the unit by either the pilot or the observer during flight. Common motor oil was injected into the exhaust manifold where it vaporized and then mixed with the cold outside air to condense into a dense oil fog, bluish-white in color. There is no need for any other colors, since the puffs or trails are well-defined against all encountered backgrounds, even clouds. Operation of the smoke generator did not measurably affect the performance of either the aircraft or the power plant, although the exhaust noise was muffled significantly. No changes have appeared on the engine instruments, nor have the FAA routine inspection revealed any adverse effects. This air marking technique was used in atmospheric research activities to visually track or maintain contact between research aircraft in flight and to track seeded plumes and air parcels. It has several advantages over conventional tracking devices such as chaff or balloons, in that it can easily be positioned in the air, a large quantity of marker can be carried, it is inexpensive to operate, and it is highly visible. It should be useful in diffusion and convection studies, as well as in larger scale air motion analyses.

5906 APTIC NUMBER 15227

Niles, F. E.
AIR-LIKE DISCHARGES WITH CO2, NO, NO2, AND N2O AS IMPURITIES. Ballistic Research Labs., Aberdeen Proving Ground, Md., BRL-R-1437, 73p., June 1969. 18 refs.
AD 690816

Computer solutions to 24 times-rate-of-change equations were obtained for air-like discharges attainable in a laboratory designed for the study of reactions of ionospheric importance. The manner in which the solutions are affected by initial number densities of CO2, NO, NO2, and N2O, corresponding to the impurity levels of 0, 0.1, 10, and 1000 ppm, is presented. Solution of the time-rate-of-change equations demonstrated the importance of knowing the initial concentrations of minor

constituents. The initial N2O densities did not affect the solutions. The initial CO2 densities are not very important to the solutions. The CO3(-) solutions are influenced by the ozone density, which is affected by the NO2 density. The initial NO2 density greatly affects the reactions forming the negative ions. The initial NO density greatly affects the observable positive ion densities. While the solutions were obtained for the laboratory facility, similar effects on the charged particles in the upper atmosphere can be expected for various densities of NO and NO2. Hence, measurements of the NO and NO2 densities should accompany charged particle measurements in the upper atmosphere.

5907 APTIC NUMBER 14907

Oelschlaeger, Walter
INFLUENCE OF THE ASHING METHOD ON THE RESULTS OF FLUORINE DETERMINATIONS. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(12):25-27, Dec. 1968. 6 refs.

Errors in fluorine determinations of biological samples occur when ashing of samples is carried out in a muffle furnace. The analytic results are distorted because the furnace always contains relative high quantities of fluorine. At 450 C up to 80% F is simulated; at 550 C up to 390 F is simulated. For the investigation of samples which only contain a small amount of fluorine and to which CaO must be added before incineration, it is absolutely necessary to use a gas-tight muffle furnace lined with platinum plates. A furnace with nickel plate lining may be used in most cases for other vegetable samples and for hard tissues.

5908 APTIC NUMBER 14858

Okamoto, G., J. Horiuti, and K. Hirota
APPLICATION OF TRANSITION STATE METHOD TO THE HETEROGENEOUS REACTION ON HYDROGEN ELECTRODE. ABSOLUTE CALCULATION OF ISOTOPIC INTERCHANGE REACTION VELOCITY, CATHODIC AND ANODIC CURRENTS AND ISOTOPIC SEPARATION FACTOR. Sci. Papers Inst. Phys. Chem. Res. (Tokyo), 29(641):223-251, July 1936. 17 refs.

The transition state method was extended to the heterogeneous reactions, with special application to the hydrogen electrode process. The rate-determining step for Pt, Ni, Fe, and Cu electrode metals was assumed to be the catalytic atomization of the hydrogen molecule on the electrode. Expressions for the absolute rate of various electrode processes were calculated with known data in the case of the nickel electrode. Essentially correct order of magnitude was obtained for the absolute value of the anodic current, the cathodic current, the isotopic separation factor, the isotopic interchange reaction velocity, and for their temperature coefficients. Behavior of these quantities with varying polarization is in agreement with the catalytic atomization theory. It is concluded that (110) lattice plane for nickel is most catalytically active in the hydrogen electrode process. Catalytic activity is not restricted to some exceptional 'active spot', as generally believed. The theoretical fact that every pair of metal atoms at the separation of 3.52 A is active leads to the correct order of magnitude for the reaction velocity. That the catalytic atomization is the rate-determining process was established for the nickel electrode. Interchange reaction on a metallic catalyst proceeds in the order Pt, Ni, Fe, Cu, Au, Ag. For poorer catalysts, the rate-determining step is the same as nickel. In the case of platinum, which is a better catalyst, ionization of the atom might possibly be rate-determining or atomization and ionization might alternate in governing the rate. If the latter assumption is true, the electrode process on platinum would be very complicated.

5909 APTIC NUMBER 15475

Owen, Louis F.
AN INVESTIGATION OF IMPROVED SAMPLE HANDLING PROCEDURES IN ULTRASONIC NEBULIZATION TECHNIQUES. Tomorrow Enterprises, Portsmouth, Ohio, Contract F33615-67-C-1565, Proj. 7360, Task 736005, AFML-TR-68-358, Rp., Dec. 1968.
CFSTI: AD-688573

A new ultrasonic nebulizer produces useful aerosols from sample solutions continuously presented to its vibrating face. The vibrating element is a coated piezoelectric crystal transducer. The element is mechanically loaded and electrically driven from its back side only; its working face is coated with a ceramic glaze of a low-melting point glass that is resistant to many analytical solutions. However, even more resistant coatings are needed. It is hoped that improved versions of the coated transducer will evolve from the present device. Modifications of plasma jet design is also anticipated to make high efficiency excitation zones available for spectroscopic viewing. To produce an aerosol useful for instrumental analytical technique, development efforts will continue on adequate solution-pumping systems.

5910 APTIC NUMBER 14523

Pack, Donald H.
THE EVOLUTION OF A SUB-SYSTEM. International Business Machines Corp., White Plains, New York, Data Processing Div., Proc. IBM Scientific Computing Symp. Water and Air Resource Management, Yorktown Heights, N. Y., 1967, p. 235-249. 3 refs. (Oct. 23-25).

The history of a meteorological research project, the relationship between various air pollutants and weather data, is discussed in terms of computer utilization in this area of air resource research. Since the atmosphere simply receives, transports, dilutes, modifies, and deposits pollution, meteorology is a 'sub-system' of air resource management. The meteorological aspects of pollution cannot be studied in complete isolation without reference to the sources and the effects of pollution. The fact is that a sub-system makes it mandatory that the research program maintain flexibility. Modeling and computer programs demand open-ended, input, and output design. In the early phase of exploration, testing, and problem definition, i.e., the period of statistical studies, it is neither possible nor desirable to freeze studies for a massive computational effort. As

statistical studies take shape, the construction of analytical models of the meteorological transport and dilution of pollution become necessary. It is suggested that there is a need for at least two types of each model. The first is a complex computer-oriented one which can portray detailed time and space fields of concentrations. These require advanced computational facilities, but large urban areas with severe pollution problems need this kind of information. There is also another class of problems where both the needs and the available data do not require this degree of complexity. In these circumstances, the appropriate model will not require high-speed computer facilities. A bibliography of 39 titles is included.

5911 APTIC NUMBER 18685

Pannetier, Guy and Leon Davignon
CHEMICAL AND KINETIC STUDY OF THE ACTION OF SULFUROUS ANHYDRIDE ON IRON AND ITS SULFIDES. (Etude chimique et cinetique de l'action de l'anhydride sulfureux sur le fer et ses composes sulfures). Text in French. Bull. Soc. Chim. France, no. 12:2818-20, 1963. 16 refs.

New reactions between sulfur dioxide and iron and its sulfides were discovered when a current of sulfur dioxide was passed over a finely divided bed of solid iron at temperatures between 220 and 565 C. It was shown that the reaction with iron resulted in FeS2 and Fe3O4, that the products of the reaction between FeS and Fe3O4, were successively Fe7S8 and FeS2 as the temperature increased. The latter was converted to Fe3O4 with the loss of sulfur. The energy of activation for each of the reactions was evaluated.

5912 APTIC NUMBER 18285

Pannetier, Guy
EXPERIMENTAL RESEARCH ON THE COMBUSTION MECHANISM IN THE GASEOUS PHASE. (Recherches experimentales sur le mecanisme des combustions en phase gazeuse). Text in French. Rev. Inst. Franc. Petrole Ann. Combust. Liquides (Paris), 4(5):166-179, May 1949.

Various attempts are made to explain the production of free radicals in active combustion. Constants of the ClO radical are given. Proof of the origin of these radicals resulted from the study of cyanogen, which enabled an explanation to be made for the mechanism of combustion and the influence of various factors. Various inflammability limits are also discussed in light of the mechanism. Reactions between free radicals explained differences between inflammability limits of dry and wet cyanogen. The cause of the results with methyl oxide and acetylene could not be explained. Inflammability limits could not be considered as specific chemical individuality constants. The study concluded that even propagation speeds of combustion of a given compound vary when the inner surface of the vessel in which it propagates is altered. (Author abstract modified)

5913 APTIC NUMBER 18644

Pannetier, Guy and Leon Davignon
INTERACTION OF COBALT AND SULFUROUS ANHYDRIDE. (Sur l'interaction du cobalt et de l'anhydride sulfureux). Text in French. Bull. Soc. Chim. France, no. 7:1509-1512, 1964. 5 refs.

The forward and reverse reactions between finely divided metallic cobalt and gaseous sulfur dioxide were studied chemically and kinetically. The velocity of each of the two reactions was limited by a process at the interface; the forward reaction by the particles of cobalt and the reverse reaction by the particles of cobalt sulfide. The reaction was 3Co plus SO2 yields 2CoO plus CoS. The energy of activation of the forward reaction was 56.3 kcal/mole and for the reverse reaction 46.7 kcal/mole.

5914 APTIC NUMBER 18687

Pannetier, Guy and Leon Davignon
INTERACTION OF NICKEL AND SULFUROUS ANHYDRIDE. (Sur l'interaction du nickel et de l'anhydride sulfureux). Text in French. Bull. Soc. Chim. France, no. 9:2304-2312, 1964. 14 refs.

The action of sulfur dioxide on finely divided nickel gives the following reaction: 7Ni plus 2SO2 yields 4NiO plus Ni3S2. This reaction is very exothermic and develops rapidly up to 460 C. The sulfide Ni3S2 can then react with sulfur dioxide to give the oxide NiO and the sulfide NiS, the latter being transformed finally into NiO. Below 460 C, the attack on the sulfides by sulfur dioxide is slow and considerably limited by the process of diffusion; it can be regarded as negligible and the above reaction then becomes the only reaction occurring below 460 C. The kinetics of this reaction were studied by thermogravimetry using a fluidized bed. The interpretation of the results showed that the progression of the interface is the limiting factor. The reverse reaction between the oxide and sulfide, 4NiO plus Ni3S2 yields 7Ni plus SO2, is limited by the internal diffusion at the level of the grains of nickel oxide.

5915 APTIC NUMBER 18637

Pannetier, Guy and Leon Davignon
STUDY OF THE ACTION OF SO2 ON IRON SULFIDES. (Etude de l'action de SO2 sur les sulfures de fer). Text in French. Compt. Rend. (Paris), 256(20):4447-4449, May 20, 1963. 6 refs.

Synthetic ferrous sulfide in powdered form in a current of sulfur dioxide gives Fe7S8 and FeS2 in addition to Fe3O4; FeS2 is then transformed into Fe3O4 with the loss of sulfur. The phases resulting from the reaction were analyzed by powder x-ray diffraction. Between 220 and 380 C, the reaction is essentially 38FeS plus 2SO2 yields 5Fe7S8 plus Fe3O4; between 380 and 455 C the reaction is 4Fe7S8 plus 6SO2 yields 19FeS2 plus 3Fe3O4; above this temperature, the reaction is 3FeS2 plus 2SO2 yields Fe3O4 plus 4S2. This stoichiometric study was completed by a kinetic study of the oxidation of Fe7S8 and FeS2 by SO2.

5916 APTIC NUMBER 14383

Panoiu, Nicolae
INFLUENCE OF THE PHYSICAL PROPERTIES OF SOLID SUSPENSIONS ON THE ISOTHERMAL BIPHASIC OPERATION OF HORIZONTAL CYCLONE FURNACES. (Einfluss der physikalischen Merkmale fester Suspensionen auf den isothermischen Zweiphasenbetrieb der horizontalen Zyklonfeuerung). Text in German. Rev. Roumaine Sci. Tech., Ser. Electrotech. Energet., 13(4):635-647, 1968. 9 refs.

No major aerodynamic changes are required for biphasic operation of the cyclone furnace as compared with single phase operation. Frequently only the numerical values of the most important operational parameters must be changed. Biphasic operation is characterized by lower tangential velocities at the same liquid throughput and shape of the combustion chamber than in single-phase operation. Moreover, it is characterized by the concentration of solid suspended in the carrier gas. Using theoretical and experimental results provided by the literature, the aerodynamic resistance, the tangential velocity, and the radial trajectory were calculated. The results showed that with increasing concentration in the solid phase, the residence time becomes shorter and the radial speed of the particles decreases. With increasing specific weight of the solid suspension, the residence time and the radial speed of the particles increased. Increase of the equivalent diameter of the particle reduced the residence time, but the particle trajectories were maintained. To verify the theoretical results, experiments were conducted. With a high-speed camera, the trajectories of the solid particles introduced into the carrier gas were photographed, and the particle trajectories and residence times were determined. Good agreement was found between the experimental and the theoretical results.

5917 APTIC NUMBER 15278

Parsons (Ralph M.) Co., Los Angeles, Calif.
CONSOL SYNTHETIC FUEL PROCESS: 1968 FEASIBILITY REPORT. Contract OCR 14-01-0001-255, R D Rept. 45, 121p., 1969.
CFSTI: PB 183 560

A re-evaluation of the Consol synthetic fuel process and the process design of a commercial plant to produce gasoline from coal was presented. Based on scale-up of laboratory and small pilot plant data, a commercial plant having a charge capacity of 29,522 tons per day of coal can produce 48,026 barrels per day of gasoline, half 100 octane premium and half 93 octane regular. It was estimated that such a plant would cost $288,500,000 (1968) excluding land, catalysts, royalties, and working capital. Based on generally accepted economic calculations, the average selling price of gasoline produced of 6.8% of investment would be 15.5 cents per gallon at the plant delivery rack. A study of published price information indicates that the average selling price of regular and premium gasoline in the area selected for this plant study is between 13 and 18 cents per gallon net to the refiner. At this price, the economic feasibility of the project continues to be marginal. The design and cost estimate of this plant is consistent with the most advanced methods of pollution control where standards for this control have been established. Unfortunately, coal is a high sulfur- and ash-containing material and universally acceptable practices for burning coal without pollution are not established. Pollution problems from this plant will be caused principally by the burning of char for process heat and in the power plant in which electrical power is generated. Another source of trouble could be the carbon dioxide reject stream from the hydrogen plant. This stream is expected to have a composition of approximately 99.9% carbon dioxide and 0.1% hydrogen sulfide.

5918 APTIC NUMBER 15292

Parsons (Ralph M.) Co., Los Angeles, Calif.
FEASIBILITY REPORT - CONSOL SYNTHETIC FUEL PROCESS SYNTHETIC CRUDE PRODUCTION 1969. Contract OCR 14-01-0001-255, R and D Rept. 45, Interim Rept. 2, 139p., 1969.
CFSTI: PB 184 330

A re-evaluation of the Consol synthetic fuel process and a conceptual process design of a commercial plant to produce synthetic crude oil from coal is presented. Based on scale-up of laboratory and small pilot plant data, a commercial plant having a charge capacity of 19,086 tons per day of coal can produce 45,931 barrels per day of 33.8 API crude oil. It was estimated that such a plant will cost approximately $189,300,000 (1969) excluding land, catalysts, royalties and working capital. Based on generally accepted economic calculations, the average selling price of synthetic crude produced from such a plant, including profit (after 52.8% income tax) of 6.8% of investment would be $5.18 per barrel at the plant. At this cost, the production of synthetic crude in an operation similar to that described in the report is unattractive. However, it is possible to extrapolate the results of this study and to project a massive operation producing approximately 250,000 BPSD of synthetic crude oil from Western coal (priced at 5¢/MMBTU) at a plant site price of about $3.25 per barrel, which is attractive for this type of oil. There is no natural crude oil having properties comparable to this oil. This oil is distinguished by having a 100% rectified distillate product of approximately 750 F endpoint, and therefore contains no residuum. The product contains approximately 80 volume % of distillate mid-boiling range oil which is of considerably lower gravity than cuts of corresponding boiling point from most natural crude oils. This is due to a high aromatic content. (Author summary modified)

5919 APTIC NUMBER 15049

Patel, C. K. N., P. K. Tien, and J. H. McFee
CW HIGH-POWER CO2-N2-HE LASER. Appl. Phys. Letters, 7(11):290-292, Dec. 1, 1965. 6 refs.

The addition of helium to a large diameter CO-N2 laser increased CW power output from 12.0 W at 10.6 microns to 106.5 W at

10.6 microns. Spectrometric analysis of the vibrational band of CO2 showed two transitions in oscillation: one at P(20) and another at P(24). Conversion efficiency of the dc discharge power at 10.6 is about 6.2%. When the same laser was operated under quasi-CW conditions by exciting the discharge with rectified but unfiltered ac, peak power was 2470 W. This corresponds to a conversion efficiency of 7.8%. Addition of other noble gases did not increase power output. The order-of-magnitude improvement in laser output on addition of helium is assumed to arise from the possiblity of transfer of energy from metastable He atoms to N2 molecules. The proposed energy transfer mechanism involves a three-body collision and the reaction is near resonant.

5920 APTIC NUMBER 15197

Paulson, J. F.
SOME NEGATIVE ION REACTIONS IN SIMPLE GASES. In: Symp. Ion-Molecule Reactions in the Gas Phase, Robert F. Gould (ed.), Washington, D. C., American Chemical Society, 1966, p. 28-43. 20 refs. (Presented at the Am. Chem. Soc., 152nd Meeting, New York, N. Y., Sept. 12-13, 1966.)

Charge transfer and ion-atom interchange reactions of O(-) with N2O and of O(-) with O2, N2O, and NO2 were studied with a magnetic sector mass spectrometer. Competition between electron transfer and ion-atom interchange was observed in the production of O2(-) by reactions of O(-) with O2, an endothermic reaction. The negative ion of the reacting molecules is formed in O2, N2O, and NO2, but not in H2O. Rate constants were estimated as a function of repeller potential. These studies are considered preliminary in the sense that the rate constants obtained are averages over a wide range of interaction energies and may not apply to ions having well-defined kinetic energies. Definitive tests of the dependence of these rate constants upon kinetic energy can only be carried out using ion beam techniques in which angular distributions of the products are measured. (Author abstract modified)

5921 APTIC NUMBER 18579

Pearl, Irvin A. and Donald L. Beyer
THE ETHER-INSOLUBLE, WATER-SOLUBLE COMPONENTS OF SEVERAL SPENT SULFITE LIQUORS. TAPPI, 47(12):779-782, Dec. 1964. 7 refs.

Commercially concentrated sprucewood spent sulfite liquor, hardwood sodium bisulfite spent liquor, and soft-wood sodium bisulfite spent liquor were each extracted with ether and fractionalized into 'neutrals,' 'weak acids,' and 'strong acids' by means of ion-exchange resins. Chromotography, acid and alkaline hydrolysis, and alkaline nitrobenzene oxidation were explored to study the fractions obtained from this arbitrary fractionation. Inherent differences in the chemical composition of the analogous fractions were found. Though "strong acids" of the spruce liquor contained no reducing sugar after acid hydrolysis, approximately one-fourth of the 'weak acids' fraction of the spruce liquor comprised carbohydrate components in combination. The aldehyde to ketone acid yield of 7:4:6 of the spruce spent liquor "weak acids" indicated a preponderance of material not related to lignin, but the high ratio of aldehydes to ketones to acids in the hardwood bisulfite "weak acids" gave unexpectedly high yields of aldehydes. Since the combined vanillin yields of all three fractions of the softwood sodium bisulfite spent liquor indicate that softwood sodium bisulfite lignosulfonates are more amenable to vanillin production than those of spruce spent sulfite liquor, sodium bisulfite pulping of wood may be the preferred process for producing lignosulfonates for use in commercial vanillin manufacture.

5922 APTIC NUMBER 15298

Perkin-Elmer Corp., Pomona, Calif.
ANALYTICAL STUDY OF CONTAMINANT AND ATMOSPHERIC SENSOR. PHASE 1. Contract NAS 1-7260, NASA CR-1375, 133p., Sept. 1969.

The Contaminant Atmosphere Sensor is designed to monitor the general condition of spacecraft atmospheres during extended manned spacecraft missions. It is intended to provide information on concentrations of hydrogen, water vapor, helium or nitrogen, oxygen, carbon monoxide, carbon dioxide, methane, and total hydrocarbons. This report presents the results of analyses of the resolutions and sensitivities required to monitor the above compounds in both helium-oxygen and nitrogen-oxygen atmospheres. The basic instrument of the sensor is the Two Gas Analyzer with a ball leak inlet system. This instrument continuously monitors water, nitrogen, oxygen, and carbon dioxide on four fixed collectors. For total hydrocarbon measurement, a collection for m/e 47-120 is added and, for helium oxygen atmospheres, a mass 4 collector is added. Problems encountered in carbon monoxide measurements have been resolved by accumulator cell techniques which permit carbon monoxide to be determined on an intermittent basis. The normal sample gas flow pattern is interrupted to allow the sensor to monitor CO at m/e 28 as it is desorbed from the accumulator cell. The Contaminant Sensor should meet specified performance goals while still having acceptable weight, power, and size.

5923 APTIC NUMBER 15724

Peto, T. and R. J. Waidment
TABLES OF THE UPPER LIMIT TO THE ESTIMATE OF THE DENSITY OF CONTAMINATING PARTICLES IN A MEDIUM. J. Hyg., 67(3):533-538, 1969. 2 refs.

Theoretically, the number of particles found in a random sample is an unbiased estimate of the density of the contaminant in the medium; however, this is of little practical value, particularly where the sample proves to be free from contaminants. The determination of an upper limit to the estimate of the density is often required and this upper limit is defined by a probability level. The theory of assigning an upper limit to the estimate of the degree of contamination of a medium is explained for the following cases: an uncontaminated sample drawn from an infinitely large medium, an uncontaminated sample drawn from a

medium of finite size, a contaminated sample drawn from an infinitely large medium, and a contaminated sample drawn from a medium of finite size. Tables to save computational labor are given. Their use is illustrated with samples.

5924 APTIC NUMBER 14984

Radczewski, Otto Ernst
THE SIGNIFICANCE OF SURFACE AND INTERNAL STRUCTURE IN ADHESION AND AGGREGATION. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):1-7, Nov. 1968. 32 refs.
CFSTI: PB 68-50848/11

This article deals with basic relationships between the external and internal structure of particles, and the important properties of adhesion and aggregation. The lattice structures of crystalline and amorphous substances are examined, and the dependence of external form, shape, and surface on lattice structure is shown. In amorphous-SiO2 brines, a short range order is already found which, with increasing degree of order, assumes the form of cristobalite. Free valences on the surface and on crystal edges affect the surface adsorption. The significance of structure and form for plasticity and viscosity is explained. Examples of adhesion are the red-brown iron oxide of desert quartz, the coloration of birds due to adhesion, and the agglomerated deposits of caolinite. An adsorption in the lattice shows stratified silicates with inner crystalline expansion, and zeolites with channels in the lattice. (Author summary modified)

5925 APTIC NUMBER 15302

Rahmel, A.
THERMODYNAMIC CONSIDERATIONS OF THE CORROSION IN SULFATE MELTS: THE CONSTRUCTION AND USE OF E/LOG(P SUB SO3) DIAGRAMS. (Thermodynamische Gesichtspunkte der Korrosion in Sulfatschmelzen: Die Konstruktion und Anwendung von E/log (p sub SO3)-Diagrammen). Text in German. Electrochim. Acta, 13(3):495-505, March 1968. 25 refs.

The corrosion of metals in molten alkali sulfates was studied thermodynamically. The redox potential E is shown as function of the log of (p sub SO3) for some metals such as iron, nickel, silver, and copper in the ternary eutectic of 78.0 mole% Li2SO4, 13.5 mole% K2SO4, and 8.5 mole% Na2SO4 at 600 C. Construction of the diagrams was largely analogous to that used by Ingram and Janz for molten carbonates. The importance of the sulfide formation in the corrosion of molten sulfates is stressed; it narrows the range in which metal is thermodynamically stable. The diagrams show the great importance of sulfur trioxide in the corrosion process. With silver, corrosion begins at SO3 partial pressures of more than 0.000006 atm. Here cathodic protection is possible while with copper cathodic protection becomes effect at p sub SO3 less than ten to the minus eighth atm. Iron and nickel cannot be cathodically protected, since the molten sulfate would be reduced. Considerable sulfide corrosion would be the consequence. These metals, however, are passive at small SO3 pressures owing to the formation of oxide. The E/log(p sub SO3) diagrams cannot fully express the reciprocal effect between metal and sulfate melt. They indicate nothing about kinetics and mechanisms.

5926 APTIC NUMBER 14347

Ramirez-Munoz, J. and W. F. Ulrich
SENSITIVITIES IN ATOMIC ABSORPTION SPECTROPHOTOMETRY. I. DEFINITIONS AND INFLUENCING FACTORS. Flame Notes, Beckman, 1(2):33-37, 1966. 4 refs.

In the use of atomic absorption spectrophotometry for trace analyses, the sensitivities and detection limits achieved under different experimental conditions are important values for evaluating techniques and comparing results. In an effort to promote consistent usage among various investigators, so that work relating to these concepts can be compared, a proposed standard definition of each is presented. When sensitivity is related and/or defined on the basis of the percent absorption observed and measured with the system, it can be represented by the corresponding Percentual Concentration Limit (PCL), defined as the concentration, in ppm of analyte, giving a signal corresponding to 1% absorption under some given operating conditions. On this basis, sensitivity is defined as a percentual sensitivity. Detection limits depend on this percentual sensitivity, plus the uncertainty of the measurement caused by noise. Thus detection limits, if defined as concentrations, can be expressed in terms of the Fluctuational Concentration Limit (FCL), being the concentration in, ppm of analyte, giving a signal corresponding to the peak-to-peak noise obtained at 0% absorption level under some given operating conditions. The significance of these terms and their application to both relative and absolute measurements are discussed. A number of factors are described which influence PCL and FCL values: these are source, burner efficiency, fuel-oxidant system, path length, sample optics, burner height, resolution, detector, alignment, and sample.

5927 APTIC NUMBER 15385

Rastorguyeva, R. V.
ELECTRIC MOMENT OF A SPHERICAL PARTICLE TAKING INTO CONSIDERATION THE CONDUCTIVITY OF THE PARTICLE AND OF THE MEDIUM. Izv. Vysshikh Uchebn. Zavedenii Fiz., 9(6):7-10, 1966. 3 refs. Translated from Russian by J. Stock. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., FTD-HT-23-558-68, Proj. 72301-78. 6p., Sept. 5, 1968.
CFSTI, DDC: AD 683163

The electric moment was calculated for a spherical particle of a known diameter. The moment is expressed as a function of the diameter, electric field, and dielectric constants and conductivities of both the particle and the surrounding medium. A particle in an alternating current was studied in detail. Experiments conducted on mineral separation showed that the derived formula for the electrical moment of a spherical particle corresponds to the behavior of particles in a heterogeneous field. (Author abstract modified)

5928 APTIC NUMBER 10516

Rechnitz, G. A., T. P. Lin, and S. B. Zamochnick
POTENTIOMETRIC MEASUREMENTS WITH SO4(2-) AND PO4(3-) SENSITIVE MEMBRANE ELECTRODES. Anal. Letters, 1(1):29-33, 1967. 3 refs.

The results of several preliminary experiments carried out on prototype electrodes sensitive to SO4(2-) and PO4(3-) ions are reported. The sensitive portion of the SO4(2-) electrode consists of fine BaSO4 particles imbedded in a silicone rubber membrane. The PO4(3-) electrode uses a sparingly soluble phosphate salt, apparently BiPO4, as the active component of the membrane. Measurements were carried out using the electrodes in conjunction with a fiber-junction, saturated calomel reference electrode and a research model pH meter. Sulfate activities were measured to within 5% reliability by direct potentiometry using the sulfate electrode. The halide ions interfere in concentrations above 0.001M. Potential drifts were observed with the PO4(3-) electrode and a crude calibration curve had to be constructed. Approximate phosphate activities of plus or minus 20% were measured using the calibration procedure, provided such interferences as Cl(-), Br(-), I(-), and HCO3(-) are absent. Since neither electrode shows remarkable selectivity to the ion of primary interest, the best employment of these electrodes may be as indicator electrodes in potentiometric titrations where selectivity is not of great importance.

5929 APTIC NUMBER 15012

Reeds, J. W. and Karl Kammermeyer
ADSORPTION OF MIXED VAPORS. Ind. Eng. Chem., 51(5):707-709, May 1959. 17 refs.

Measurements of the rate of diffusion of components of the system methanolbenzene through porous glass blocks revealed the existence of an adsorption azeotrope in analogy to vapor-liquid azeotropes. At the temperatures studied (15, 25, and 35 C), benzene was preferentially adsorbed from the azeotropic vapor-liquid mixtures. However, when present in very high concentrations, methanol was preferentially adsorbed. Thus a composition must exist in the intermediate region which would absorb unchanged in composition. Since the equilibrium between the composition of the vapor and the composition of the adsorbate is graphically similar to common isothermal vapor-liquid equilibria for minimum boiling mixtures of binary constituents, this crossover composition is called an adsorption azeotrope. The curve for vapor-adsorbate equilibrium is, however, shifted toward the methanol-rich side of the vapor-liquid equilibrium system. This shift is more pronounced at lower temperatures or lower pressures. The existence of adsorption azeotropes, is established in these vapor adsorption studies on the benzene-methanol system, has implications in all separation processes using adsorption methods. (Author conclusions modified)

5930 APTIC NUMBER 10512

Reisman, Arnold, Frederic Holtzberg, and Ephraim Banks
REACTIONS OF THE GROUP VB PENTOXIDES WITH ALKALI OXIDES AND CARBONATES. VII. HETEROGENEOUS EQUILIBRIA IN THE SYSTEM Na2O OR Na2CO3-NB2O5. J. Am. Chem. Soc., 80(1):37-42, Jan. 5, 1958. 19 refs.

The heterogeneous equilibria in the system of Na2O or Na2CO3-Nb2O5 were investigated by differential thermal analysis, X-ray analysis, and density measurements. Four compounds corresponding to the formuli Na2O-3Nb2O5(I), Na2O-Nb2O5(II), Na2O-Nb2O5(III), and 3Na2O-Nb2O5(IV) were identified. Compounds I and II melt incongruently at 1309 and 1277 deg, respectively, and compounds III and IV melt congruently at 1422 and 997 deg, respectively. The polymorphism of compound III was reinvestigated, and results indicate the existence of four phases with transitions at 680, 562, and 385 deg. The 562 deg transition was observable as a sharp heat effect only after extensive annealing. In a reexamination of the polymorphic behavior of Na2CO3, latent heat anomalies were observed at 485 and 355 deg. X-Ray powder data are given for compounds I, II, III, and IV. (Author abstract modified)

5931 APTIC NUMBER 15291

Reiter, Reinhold
ON RADIOACTIVE EQUILIBRIUM IN ATMOSPHERIC AEROSOLS AT 700 AND 1800 M A S L AS INFLUENCED BY PARTICLE SIZE AND VERTICAL MIXING ACTIVITY. Pure Appl. Geophys. (Basel), 74(3):134-148, 1969. 8 refs.

Data from simultaneous measurements of RaB and RaC concentration in atmospheric aerosols, taken at sites located roughly 700 and 1800 m a.s.l. (above sea level), were used to elucidate the relationship of the ratio of the specific activities of RaB and RaC in aerosol particles to the intensity of vertical mixing and the size of the aerosol particles. The empirical relationships from a 15-month period of uninterrupted measurements are presented. Radioactive equilibrium is more nearly approached in aerosol particles of more than one micron in diameter than in smaller ones (including the smallest measurable sizes). This hold invariably and for all height levels. The degree of approach to RaB/RaC equilibrium is the lowest for low altitude (700 m) and negligible vertical mixing, i.e., 65% to 75%. At the low-altitude site, this figure increases to 80%-90% as the intensity of vertical mixing reaches higher levels. At 1800 m a.s.l., the degree of approach to RaB/RaC equilibrium is nearly 100% when vertical mixing is negligible and declines with increased vertical mixing activity to a level of only 60-70% for conditions involving strong vertical mass exchange. (Author summary modified)

5932 APTIC NUMBER 15820

Peny, M. and K. Buhland
ON MISTS DISPERSED BY CHEMICAL REACTIONS. II. ON THE ABSORPTION OF CHEMICAL MISTS. (Ueber die bei chemischer Reaktionen auftretenden Nebel. II. Ueber die Absorption chemischer Nebel). Text in German. Z. Anorg. Allgem. Chem., vol. 139:51-68, 1924. 1 ref.

The dependence of the absorption of wet and dry SO3 and ammonium chloride mists on the electrolyte concentration and on the vapor pressure of the absorbent was studied. Wet SO3 mists were produced by passing an air stream saturated with moisture through fuming sulfuric acid. The absorption flask contained 5 cc water or sulfuric acid of a certain concentration. The gas or mist passed through the apparatus in 3 minutes. Dry SO3 mists were obtained by passing a mixture of oxygen and SO2 over platinum asbestos contained in a glass pipe heated to 430 C. The SO2 was dried in two scrubbers with concentrated sulfuric acid. The dry ammonium chloride mist was obtained by sublimation in a dry air stream and extended passage in gaseous form through a heated tube. Illustrations of the various apparatuses are given. It was found that for the absorption of dry chemical mists (colloidal dusts), the water vapor tension of the solution used is of primary importance. The curve obtained by plotting the absorption capacity of sulfuric acid for dry SO3 mists as a function of its concentration runs parallel to the sulfuric acid boiling point curve. Dry ammonium chloride, too, is much more readily absorbed by more concentrated aqueous solutions (ammonium chloride and calcium chloride solutions). Wet mists, however, are generally less readily absorbed by highly concentrated solutions. Nevertheless, with a lower concentration (less than 5%) are better absorbents than water.

5933 APTIC NUMBER 15038

Rickles, Robert W. and Henry Z. Friedlander
THE BASICS OF MEMBRANE PERMEATION. Chem. Eng., 73(9):163-168, April 25, 1966. 51 refs.

Permeation involves three simultaneous events: solution of the penetrant in the membrane; activated diffusion in the direction of minimized free energy; and desorption of the penetrant on the other side. Permeation rates are generally considerably more rapid in amorphous materials than in crystalline materials. Despite the substantial body of information available on permeation for specific systems, it is not yet possible to predict permeation rates from first principles without experimentation. The irreversible thermodynamics of the process and the solubility of penetrants are discussed. A number of variables are given as external factors which affect solubility in polymers: temperature, concentration, and pressure, nature of the polymer and penetrant, the presence of other penetrants and polymers, film thickness, and changes in polymer structure by grafting or irradiation. Also considered briefly are the distinction between sorption and solubility, with sorption used to indicate a combination of adsorption and solubility; the solution of ions; the activated diffusion process in which the molecules moves from vacancy to vacancy; concentration polarization, which occurs whenever a partition between two or more substances takes place at interface, and is particularly important for liquid phases in contact with a membrane; and gas permeation, which has great potential application in packaging processes.

5934 APTIC NUMBER 15222

Riley, Malcolm W.
WHAT YOU CAN EXPECT FROM FILAMENT WOUND PARTS. PART 1. Mater. Design Eng., 52(2):128-139, Aug. 1960. 10 refs.

The pros and cons of filament winding of reinforced plastics are discussed, together with design criteria, materials, and testing methods. Individual filaments are primarily loaded only unidirectionally in tension, making it possible to design structures of maximum efficiency. Other benefits of filament wound reinforced plastics stem from the mechanized nature of the process which results in close control of process variables, economical large volume production, and consistent wall thickness. Limitations include shape, weak interlaminar shear, and poor ductility. Design suggestions are to design specifically for filament winding to use a shape that can be wound under tension, and to hold tolerances plus or minus 0.005 in. Spherical pressure vessels in diameters up to 8-10 in. can be accurately designed and produced with a high degree of reliability. A new material is the filament oriented prepreg material. It combines the preorientation of filament inherent in filament winding with the shape flexibility inherent in molding flat prepreg reinforced plastics. Property data for filament wound plastics are available, but the test methods are not given which makes the data meaningless. At present (1960), conventional E glass in the form of roving, is the most commonly used reinforcement. A new modulus glass reinforcement is being developed. For high temperature applications, high silica and quartz fibers may be useful. Synthetic organic fibers are slightly used. In addition to rovings, reinforcements in the form of tapes are used for tape wrapping. This form of winding is primarily adapted to cylindrical shapes. A resin binder is necessary to obtain maximum strength structure. The resin system must provide a strong resin-glass bond, high shear strength and an elongation at least that of glass filaments which is 2-3%. Among different types of resins discussed are bis-phenol A-epichlorohydrin epoxies, polyesters of triallyl cyanurate and styrene, phenolics, and phenyl silanes. Methods of winding are wet, dry, and post-impregnation. Basic winding patterns are circumferential winding and helical winding. Other process variables are also discussed. Test methods for developing design data are evaluated.

5935 APTIC NUMBER 18532

A METHOD FOR REGENERATION OF ADSORBENT MATERIAL AND AN INSTALLATION FOR THE APPLICATION OF THIS METHOD. (Werkwijze voor het regenereren van adsorberend materiaal en inrichting voor het toepassen van deze werkwijze). Text in Dutch. (Wimer Manufacturing Co., Ltd., Cardiff, Wales, Great Britain) Dutch Pat. 6,610,819. 9p., April 19, 1967. (Appl. Oct. 11, 1966, 9 claims).

The invention deals with a method and an installation for the regeneration of an adsorbing material as used in fractionation of gas mixtures for continuous removal of one or more components. In general, the invention relates to a method of regeneration of the adsorbing material by reducing the pressure of the chamber containing the adsorbing material to below atmospheric pressure. Two chambers are used: one for drying of compressed air and the other for regeneration of the adsorbing material. This can be achieved by valves with suitable manual or automatic controls. Any time cycle can be used, but a cycle time of 10 to 20 min is suggested for drying of compressed air and gas mixtures when using silical gel or alumina as adsorbent. This can be reduced to 40-120 sec for separating gases, depending on the type and percentage of contamination in the gas stream. It is preferable to use a partial vacuum in a fully closed chamber to remove moisture from the adsorbent so that the material is immediately available for removal of components from the gas stream. Advantages are that the method is cheap, no waste or loss of primary component occurs, there is less wear of valves due to use of longer time cycles than in other methods without reheating, and there is no heat requirement.

5936 APTIC NUMBER 14717

Niou, Paul and A. P. Berard
ON THE RATE OF ABSORPTION OF SULFUROUS GAS BY MAGNESIUM HYDROXIDE. (Sur la vitesse d'absorption du gaz sulfureux par l'hydrate de magnesium). Text in French. Compt. Rend. (Paris), 186(22):1465-1467, 1928.

The influence of temperature on the rate of absorption of sulfurous gases by solutions of magnesium hydroxide and magnesium sulfite was studied. Both compounds are very difficultly soluble in water, so that the solutions obtained were hardly different from pure water. The absorption rate in such a solution of Mg(OH)2 differed very slightly, therefore, from the rate in pure water. However, the presence of the hydroxide served to promote greater absorption at increased temperatures than would have prevailed in water alone. Increasing temperature lowers the rate of gas absorption in both cases, but absorption falls at a lower rate in basic solution. When various amounts of solid Mg(OH)2 were added to the already saturated solution at room temperature, the rate of absorption increased in direct proportion to the amount of solid added. Magnesium sulfite is so insoluble that it was difficult to measure its precise influence on absorption rate. The few measurements that could be made indicated that absorption rate decreases with increasing concentration of solid sulfite.

5937 APTIC NUMBER 15460

Rogers, C. E.
PERMEABILITY AND CHEMICAL RESISTANCE. In: Eng. Design for Plastics, E. Baer (ed.), New York, Reinhold, 1964. Chapt. 9, p. 609-689. 222 refs.

To assess the feasibility of using a polymer in a given environment, the following information is required: the rate of penetrant sorption or transport through the polymer; the magnitude and mode of sorption, i.e., the amount sorbed and the manner by which penetrant is held within the polymer; and the effect of the penetrant on the physical and chemical properties of the material. In the present study, this information was obtained by relating the barrier properties and other resistance characteristics to the inherent chemical and physical properties of the components, both the polymer and the penetrant. A compilation of data taken from the literature relating to permeability, solubility, and chemical and solvent resistance of polymers is presented in the Appendix. Additional data illustrating certain phenomena are included in the text. These data can be used as guides or order-of-magnitude estimates in lieu of experimental data for a specific penetrant-polymer combination under the exact environment conditions to be encountered in practice.

5938 APTIC NUMBER 14636

Rogers, F. and R. W. Sage
SOME STUDIES OF THE OXIDES OF NITROGEN. Office Naval Res., Monthly Res. Rept., p. 23-25, Jan. 1952. 9 refs.
ATI: 139788

An evaluation of the specific volume, thermal conductivity, and viscosity of the liquid phase of nitrogen dioxide and its mixtures with nitric oxide show that these compounds are suitable oxidizing components for binary liquid propellant systems. The compressibility of saturated nitrogen dioxide first increases, then decreases with a progressive rise in temperature. This anomaly is not present in the case of the liquid, where specific volume is a function of pressure and temperature. Under usual operating conditions, the vapor pressure of nitrogen dioxide will remain below 100 psi. The relatively high freezing point of nitrogen dioxide is effectively lowered by solutions of nitric oxide, which increase two-phase pressure. Twenty wt% nitric oxide increases the bubble point pressure of nitrogen dioxide mixtures to 885 psi at 180 F. The vapor pressure of pure nitrogen dioxide at this temperature is about 196 psi. Nitric oxide is more nearly a perfect gas than nitrogen dioxide, deviating only about 5% from the behavior of a perfect gas at pressures up to 2500 psi at 100 F. Its compressibility factor is a function of pressure for several temperatures. Neither nitrogen dioxide nor nitric oxide undergoes significant decomposition when stored in steel containers.

5939 APTIC NUMBER 15119

Ronn, A. M.
LASER-INDUCED INFRARED FLUORESCENCE. J. Chem. Phys., vol. 48:511-513, 1968. 2 refs.

Fluorescence was detected from ethylene, SF6, NH3, CH3Br, CD3I, D2S, CH3NH2, C3H8 and C2H5Cl at low pressures when irradiated by a 50-W CW CO2-N2-He laser. The apparatus used consisted of a commercial CO2 laser as a pumping source and an infrared grating spectrometer for detection. Ethylene absorbed all of

the laser lines and promoted a considerable number of molecules to the seventh excited state. Redistribution of the excited molecules to all rotational states in the vibrational band by thermalizing collisions is very rapid at a pressure of 50 mm Hg and is on the order of 0.1-10 microsec. Vibrational relaxation is much slower, approximately 0.1-10 millisec; hence, emission occurs in most rotational transitions in the band. The only exception appeared in the emission spectrum of NH3. The emission spectrum shows some intensity deviations from the absorption spectrum in that all emission lines originating from s states are slightly more intense than those from a states. The overtone transitions are also more intense in the emission spectrum. It may be that the fundamental transition is absorbing the laser's power, thus causing fluorescence from all s and a states at the same time. Although the mechanism of emission is not fully understood, the efficiency of collisional transfer is sufficient to populate a total vibration-rotation band when only a few of its members are strongly saturated.

5980 APTIC NUMBER 13520

Saleh, J. M.
KINETICS OF INTERACTION OF SULPHUR DIOXIDE WITH CLEAN AND OXIDIZED METAL FILMS OF IRON, NICKEL AND LEAD. Trans. Faraday Soc., 64(3): 796-808, 1968. 12 refs.

The interaction of SO2 with evaporated films of iron, nickel and lead has been investigated in the temperature range from -80 to about 300 C. Rapid and irreversible chemisorption occurred on both iron and nickel films at -80 C, and above 100 C extensive incorporation of the gas took place at a rate which was faster, for a given temperature and pressure, on iron than on nickel films. The incorporation occurred with a constant activation energy which was independent of the thickness of the 'product layer', and the kinetics conformed to a first-order equation; the slow step is probably the dissociative adsorption of an adsorbed SO2 layer undergoing free translation. Presorbed oxygen on nickel and iron films reduced the total amount of adsorption at -80 C, and at the same time lowered the rate of incorporation above 100 C to a great extent. A multilayer adsorption was observed on lead films at -80 C; a substantial fraction of the adsorption was reversible. No clear evidence was obtained for the incorporation of SO2 in lead films below 300 C. Presorbed oxygen on lead films considerably restricted the mobility of the activated complexes of the reaction. (Author abstract modified)

5981 APTIC NUMBER 14370

Satyanarayana Rao, T. R., G. Gelernter, and P. H. Rosenbluh
SCALE UP OF COMBUSTION POT BEHAVIOR BY DIMENSIONAL ANALYSIS. American Society of Mechanical Engineers, New York, Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 232-236. 3 refs. (May 5-8).

The nature is established of dimensionless groups characterizing combustion behavior in an incinerator. In particular, these groups should determine the influence of scale in transposing results from the combustion pot to the incinerator. The analysis indicates that if F(A) is the burning rate per unit area of grate and k is an effective reactivity coefficient, then the ratio (F(A)/k) can be expressed as a function of a minimum of four groups involving nine parameters. From inspection of these groups, it would seem that their values may well be the same in both systems for the same range of dimensional parameters in the two systems. It follows from this that the scale factor involved should be unity, i.e., combustion and burning rate data obtained in a combustion pot should transpose to an incinerator bed without change. For other things then being equal, the area burning rate can only be increased if k is increased. (Author abstract modified)

5982 APTIC NUMBER 14993

Saunders, A. W., Jr., P. L. Patterson, Jr., and L. B. Lockhart, Jr.
THE INTERACTION OF RADON DECAY PRODUCTS WITH AEROSOLS. Naval Research Lab., Washington, D. C., Chemistry Div., NRL Problem C06-06, Project RR 001-05-42-4851, NRL Report 6802, 26p., Dec. 31, 1968. 13 refs.
CFSTI, DDC: AD688837

An instrumented plastic chamber with a 1.2-cu m capacity was constructed and used to study the stability of some submicron dioctyl phthalate (DOP) aerosols and their interaction with the short-lived radioactive decay products of radon. The degree of attachment of the radon decay products to the DOP aerosols in this chamber is shown to be a function of the relative areas of the aerosol and wall surfaces. At high aerosol concentrations (100,000 particles/cu cm) 90% or more of the short-lived decay products are attached to aerosol particles. At lower aerosol concentrations and particularly when convection increases the availability of the walls for deposition, the airborne radioactivity is much less. Under the proper conditions appreciable quantities of unattached radon descendants will remain airborne. Preliminary studies of these free atoms or simple molecules show they are effectively retained by fibrous filters. They thus provide a useful tool for evaluating the retentivity of filter media toward extremely small particles and for studying the mechanism of particle capture through diffusive processes. (Author abstract modified)

5983 APTIC NUMBER 14224

Sawatani, Tsuguo and Tsuguhatsu Odajima
NATURAL OXIDATION OF DILUTE SULPHUR DIOXIDE. Translated from Japanese. Tohoku Univ. (Japan), 1 p., 1968. (Presented at the 21st Annual Meeting of the Japanese Chemical Society, Japan, 1968.)

The velocity of the oxidation of dilute SO2 gas in the atmosphere was studied. SO2 gas was generated using the method whereby air is blown through a given concentration of sodium sulfite with a predetermined pH. The gas was tested at atmospheric pressure. The reaction increased in velocity with an increase in temperature and when irradiated with a fluorescent lamp.

5984 APTIC NUMBER 15129

Saxena, V. K. and S. C. Saxena
DETERMINATION OF OPTIMUM OPERATING CONDITIONS IN A THERMAL DIFFUSION COLUMN. Indian J. Technol. (India), 4(12):347-353, Dec. 1966. 16 refs.

The separation of isotopes in a hot-wire thermal diffusion column is a complicated function of the geometry parameters, operating conditions, and nature of the gas. The procedure to be adopted in choosing the dimensions of and operating conditions for the column in order to achieve maximum separation, is discussed. The particular case of neon is considered and the shape factors appropriate for this gas on the inverse power model are used as guides in investigating separation as a function of pressure for various ratios of column geometry parameters. Useful inferences of special value for isotope separation are derived. The case in which the interaction potential is approximated by the more realistic Lennard-Jones potential is treated in similar terms. It is established that minor differences in the interatomic potential are not likely to vitiate the general conclusions of the discussion. (Author abstract modified)

5985 APTIC NUMBER 15029

Saxena, V. K. and S. C. Saxena
ISOTOPE SEPARATION BY THERMAL DIFFUSION COLUMNS. Indian J. Technol. (India), 4(8):227-230, Aug. 1966. 10 refs.

Investigations of the separation of gaseous isotopes in a hot-wire glass thermal diffusion column were undertaken to establish optimum conditions for a pilot cascade thermal diffusion plant. Equipment used comprised a high vacuum pumping unit, a gas handling and transferring unit, dc regulated power supply, and a battery of four diffusion columns. A water-cooled glass tube constituted the cold wall of the column and an axially mounted nichrome wire served as the hot wall. The axial wire was heated by the dc source. Separation was allowed to reach the steady state before sampling began. Results showed that separation is a function of pressure for fixed values of cold- and hot-wall temperature ratios. Experimentally determined values are in good agreement with calculated values for the inverse power potential and the Lennard-Jones potentials. The substitution of platinum wire for nichrome gave equally satisfactory results, but an appreciable reduction in separation occurred when ac current was used to heat the axial wire.

5986 APTIC NUMBER 14870

Scheidt, P. C. and P. C. Freiling
ION-EXCHANGE PROCESSES BETWEEN IMMISCIBLE MOLTEN PHASES. J. Phys. Chem., 69(5):1784-1786, May 1965. 7 refs.

It was suggested that the immiscible phases of alkali borate are essentially molten ion exchangers in contact with molten electrolytes. This interpretation is supported by the distribution coefficients of alkali, alkaline earth, and rare earth cations. An ion-exchange mechanism for the distribution of cations is described diagrammatically. A solute halide is introduced into the salt phase. This can distribute itself between the salt phase and the metal halide dissolved in the oxide phase. If this were the only process occurring, the concentration of the solution in the oxide phase would be clearly equal to or less than the concentration of the halide ion in that phase. However, if there is an ion exchange, there is an additional equilibrium. This equilibrium permits additional solute ion to be concentrated in the oxide phase and the possibility that the concentration of solute ion will exceed that of the halide ion. The possibility of exchange occurring in the salt phase subsequent to dissolution of oxide as alkalic metal SO2 leads to the same results. If the halide phase consists of pure solute halide, similar considerations lead to the alternative condition. Experiments confirmed the proposed ion-exchange process.

5987 APTIC NUMBER 15013

Schenck, Rudolf and W. Passbach
CHEMICAL EQUILIBRIA IN THE REACTION BETWEEN LEAD SULFIDE AND ITS OXIDATION PRODUCTS. III. (Ueber die chemischen Gleichgewichte bei der Reaktion zwischen Bleisulfid und seinen Oxydationsprodukten. III). Text in German. Chem. Ber., 81(11):2917-2925, Aug. 10, 1948. 2 refs.

In earlier studies of the system PbS + 2PbO equals 3Pb + SO2, an equilibrium shift was observed when the basic substances were subjected to temperatures above 800 C. To obtain more information on the cause of this shift, solidification phenomena of a mixture of lead oxide and lead sulfate were studied. The cooling curves of 25 different mixtures of the two components were studied as well as the solidifaication, and conversion products were determined. A mixture was heated to about 1020 C and a Le Chatelier thermocouple dipped into the melt operated an automatically recording galvanometer. No melting of the pure lead sulfate up to temperatures of more than 1000 C could be observed. The same was true for very sulfate rich mixtures. The melting point of the sulfate seems to be above 1100 C. But even if such a temperature could be achieved, it will be difficult to determine the melting point of the pure substance since SO3 is formed in the process of heating. Pure lead sulfate experiences a change in solid state which becomes apparent both at heating and cooling at 850 C. The melting point of pure lead oxide was found to be 879 C. The solidification curve shows a whole series of branches within which two maxima were observed: one at 966 C and 80% lead oxide and another at 951 C and 61.5% oxide. The compounds PbSO4-PbO (42.8 lead oxide), PbSO4-2PbO (59.5% of lead oxide), and PbSO4-3PbO (69.9% oxide) are precipated. At room temperature, the oxide rich melts decompose to a coarse powder in which lead oxide flakes can be seen. The SO2 tension curves of the three alkaline sulfates were determined.

5948 APTIC NUMBER 18665

Schenck, Rudolf
DISPERSION AND CHEMICAL AFFINITY. (Zerteilung und chemische Affinitaet). Text in German. Z. Elektrochem., 42 (10):747-752, 1936. 12 refs.

The degree of dispersion of one or more components in a binary or ternary system strongly influences the reaction kinetics and hence vapor pressures and equilibrium points. Finely dispersed materials have higher chemical potentials. Usually the phase which combines with gas is more strongly activated than the product phase. Similarly, the vapor pressure of a powder increases with decreasing grain size. Examples reviewed here include wustite in equilibrium with a reducing atmosphere, the system palladium oxide/palladium, carbonyl nickel (Ni(CO)4) the system CaCO3/CaO, and copper sulfate. Large CaCO3 particles decompose faster into CaO and CO2 than smaller ones. With palladium black, an activation energy difference of 1800 cal/mole was found between samples of different grain sizes. The influence of dispersion of reaction kinetics is significant for catalytic chemistry.

5949 APTIC NUMBER 18388

Schenck, Rudolf and F. Hammerschmidt
EQUILIBRIUM STUDIES ON THE SYSTEM CALCIUM-SULFUR-OXIGEN. II. (Gleichgewichtsstudien an dem System Calcium-Schwefel-Sauerstoff. II). Text in German. Z. Anorg. Allgem. Chem., vol. 210:305-312, 1933. 7 refs.

The equilibrium ratio of SO2 to S2 above the condensed phases CaS and CaSO4 was determined at atmospheric pressure. For this purpose, sulfur dioxide was a pressure of somewhat more than 760 Torr was passed over calcium sulfide. The entering and exiting flows were measured by two flowmeters. The reaction CaS plus 2SO2 yields CaSO4 plus S2 was rather rapid, and equilibrium was reached in a few minutes. At the lowest experimental temperature of 851 C, the average partial pressure was found to be 0.461 atm, and at the highest temperature (1075 C), the average partial pressure was 0.05123 atm. The isotherm for 850 C was computed in its entirety and plotted.

5950 APTIC NUMBER 18357

Schenck, Rudolf and F. Hammerschmidt
EQUILIBRIUM STUDIES ON THE SYSTEM SR-S-O AND BA-S-O. (Gleichgewichtsstudien an den Systemen Sr-S-O und Ba-S-O). Text in German. Z. Anorg. Allgem. Chem., vol. 210:313-315, 1933. 2 refs.

The equilibrium constants of the systems SrS plus 2SO2 yields SrSO4 plus S2 and BaS plus 2SO2 yields BaSO4 plus S2 were determined. With barium sulfide, it was not feasible to hold the flowmeter adjustment over a long period of time. Even at relatively low flow velocities, the extremely high partial pressure of the sulfur vapor and the slow attainment of equilibrium at the experimental temperatures of 600 and 622 C made it impossible to take equilibrium measurements. These were feasible only at higher temperatures, e.g., at 1082 C, where the average partial pressure was 0.5038 atm and at 1126 C where the average partial pressure was 0.4085 atm. For the reaction of strontium sulfide with sulfur dioxide, equilibrium measurements could be taken at 960, 1037, and 1110 C; the average values for the partial pressures were 0.4738, 0.2986, and 1.489 atm, respectively. A graphic illustration of the sulfur vapor partial pressures at 1 atm as a function of the temperature for all three alkaline earth systems (CaS, SrS, and BaS) is given. It shows that the sulfur partial pressures are highest with barium, lowest with calcium, and that BaS has the highest resistance toward sulfur vapor.

5951 APTIC NUMBER 18573

Schenck, Rudolf and Ernst Raub
EQUILIBRIUM STUDIES ON THE SYSTEMS CO-S-O AND NI-S-O. (Gleichgewichtsstudien an den Systemen Co-S-O und Ni-S-O). Text in German. Z. Anorg. Allgem. Chem., vol. 178:225-251, 1929. 18 refs.

Studies on the equilibrium system 2CoO plus CoS yields 3Co plus SO2 were begun by watching the effect of SO2 on cobalt metal. No equilibria could be observed up to temperatures of 1050 C, but the reaction yielded cobalt sulfide and cobalt oxide which could be used for the study of the equilibrium system, 3CoSO4 plus CoS yields 4CoO plus 4SO2. Gas formation was first detected at 240 to 250 C, but in general, the forward reaction was slow (more than 200 hrs) and the reverse reaction was even slower. The pressure vs temperature curve is a smooth parabola from 250 to 600 C. The thermal dissociation of cobalt sulfate was also measured. The values closely approached the true equilibria of the system 2CoSO4 yields 2CoO plus 2SO2 plus O2. The first step in the study of the system Ni-S-O was to determine whether elemental nickel reacts with sulfur dioxide completely. Experiments in this direction showed that at atmospheric pressure and 550 C, a mixture of defined composition (NiS/NiO) was obtained. Univariant and bivariant equilibria were found. To determine their composition, the isothermal dissociation was studied. It was found that the univariant equilibria belong to the system NiO, NiS, gamma-mixed crystals, SO2-atmosphere. Upon removal of SO2, the NiS phase disappears and bivariant equilibria are obtained with the phases NiO, gamma-mixed crystals. SO2-atmosphere.

5952 APTIC NUMBER 18471

Schischkov, D., M. Kolcharova, D. Ivanov, Z. Galunski, G. Dimov, K. Gruev, and D. Grueva
A STUDY OF THE CONVERSION OF CARBON MONOXIDE AND THE SIMULTANEOUS REMOVAL OF NITRIC OXIDE AND OXIGEN FROM THE SYNTHESIS GAS WITH LOW-TEMPERATURE CATALYSTS. (Studie ueber die Konvertierung von Kohlenoxid und die gleichzeitige Entfernung von Stickoxid und Sauerstoff aus Synthesegas mit Hilfe von Tieftemperaturkatalysatoren). Text in German. Allgem. Prakt. Chem. (Vienna), 20(3):68-70, 1969. 8 refs.

Low-temperature catalysts developed at the Chemical Technological Institute in Sofia, Bulgaria, were tested with

respect to their activity in the conversion of carbon monoxide and hydrogenation of nitric oxide and oxygen. The synthesis gases had an average composition of 88% H2, 3.5% N2 and Ar, 5.4% CO, 2.5% methane, 0.6% CO2, up to 5 mg/cu m H2S, up to 0.5 ppm H2O, and up to 1000 ppm O2. Catalytic activity was judged by the residual content of CO, H2O, and oxygen in the synthesis gas. The basic constituents of the catalysts are the oxides of zinc, copper, and chromium. The specific surfaces of the non-reduced catalysts were between 30 and 60 sq m/g. To protect the catalysts against sulfur compounds, they were coated with a layer of desulfurized zinc oxide. Reduction of the catalysts took place at temperatures below 250 C with a gas mixture diluted with nitrogen. The results showed that the same carbon monoxide concentration was obtained with all catalysts. They further showed that the throughput velocity had a considerable influence on the residual CO content, but that this influence becomes weaker at higher temperatures. The catalysts have the capacity to reduce nitric oxide and oxygen, making it feasible to convert carbon monoxide and clean the synthesis gas in one step.

5953 APTIC NUMBER 14935

Schnabel, Werner
THE CHARGING AND ADHESION OF SMALL PARTICLES. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):19-24, Nov. 1968. 9 refs.
CFSTI: TT 68-50408/11

The electric charge of interfaces and the electrostatic double layer adhesion between solids is discussed on the basis of the band model. In the adhesive system photoconductor-metal, illumination may vary the electronic properties of the photoconductor and hence the electrostatic double layer adhesion without influencing the van der Waals forces of attraction. This effect was demonstrated in experiments on spherical zirconium particles and photoconducting cadmium sulphide substrates using an ultracentrifuge. The experiments showed that the electrostatic double layer may contribute significantly to the adhesion between solids. (Author summary modified)

5954 APTIC NUMBER 14954

Schoen, Richard I.
LABORATORY MEASUREMENTS OF PHOTOIONIZATION, PHOTOEXCITATION AND PHOTODETACHMENT. Boeing Scientific Research Labs., Seattle, Wash., Geo-Astrophysics Lab., D1-82-0768, 75p., Oct. 1968. 78 refs. (Presented at the Symposium on Laboratory Measurements of Aeronomic Interest, International Association of Geomagnetism and Aeronomy, Toronto, Canada, Sept. 3-4, 1968.)
CFSTI, DDC: AD 682082

Laboratory measurements of ionization, fluorescence, and photodetachment, limited to molecules of aeronomic interest but excluding atoms, are reviewed. Current data are presented on photoionization cross sections, cross sections for the excitation of particular states of ions, relative vibrational excitation probabilities, photodetachment cross sections, angular distributions of electrons from photoionization and dissociative excitation of neutral molecules. The following suggestions were made. At wavelengths where important solar lines lie within strong band structure, measurements of photoionization cross section of O2 and N2 with higher resolution may be required. Because of conflicting data on the photoionization cross sections of CO2, further investigation of the photoionization and photoabsorption cross sections may be required. More work is required on the details of ionization processes. The range of measurement should be extended to wavelengths shorter than 400 A. There is need for a set of accurate measurements at wavelengths of solar lines from threshold to 100 A. These measurements must be made in a system unaffected by the angular distribution of the charged particles. More information is needed about angular distributions. The combination of electron energy, ion energy, and fluorescence measurements presents a powerful array for the analysis of photoionization phenomena. It appears that the most accurate cross sections for the excitation of those states which decay by fluorescence can be obtained by combining the best cross sections measured in electron energy experiments at 500 A with relative fluorescence efficiencies measured over a range of wavelengths of the exciting vacuum UV radiation. Dispersion of the fluorescent radiation is highly desirable, but care must be taken to check for polarization effects, which may be functions of the wavelength of the exciting radiation. In many cases, fluorescence represents the best method for detecting the existence of excited states. It would seem that much more work is required in the examination of fluorescence caused by vacuum UV radiation at all wavelengths of incidence and for more molecules of aeronomic interest.

5955 APTIC NUMBER 15353

Scholten, J. J. F. and J. A. Konvalinka
REACTION OF NITROUS OXIDE WITH COPPER SURFACES. APPLICATION TO THE DETERMINATION OF FREE-COPPER SURFACE AREAS. Trans. Faraday Soc., vol. 65 Part 9(561):2465-2473, Sept. 1969. 14 refs.

Oxygen adsorption via nitrous oxide decomposition on various copper powder samples and three copper-on-MgO catalysts was investigated from 0 to 180 C at 20 cm Hg. As with germanium, the reaction of nitrous oxide with copper surfaces has an activation energy that increases with coverage. Plots of oxygen chemisorption via nitrous oxide decomposition at various temperatures as a function of contact time show that adsorption increases with temperature, indicating that there is no adsorption equilibrium. Because of the activated nature of the N2O decomposition-adsorption process, small increases in temperature of the samples caused by the heat of reaction can result in higher coverages. The magnitude of such small temperature rises will depend on the surface area per g and on the heat dissipation during measurements; this accounts for the poor reproducibility of the coverages found at 0, 20, and 50 C. Measurements of free-copper surface areas of catalysts around 90 to 100 C show better reproducibility. There is a full surface coverage in this range, so that a relatively high kinetic barrier has to be overcome before bulk oxidation sets in. The lower reactivity in both surface and bulk reactions of nitrous oxide as compared with that of oxygen is discussed. It is

presumed to be related to the difference in electronic structure of the two molecules. The linear nitrous oxide molecule has the lower reactivity, since it is apparently stabilized by resonance. Oxygen is more reactive owing to its pseudo-radical character caused by the presence of two unpaired electrons.

5956 APTIC NUMBER 15428

Schuette, R. and D. Seidel
TESTING THE SEPARATING NOZZLE METHOD IN A CLOSED SYSTEM. (Erprobung des Trennduesenverfahrens in einem geschlossenen Verfahrenskreislauf). Text in German. Chem. Ing. Tech., 39(2):80-88, 1967. 9 refs.

A closed system was established to test the effectiveness of separating nozzles for separating uranium isotopes. A mixture of 5 mole% UF6 and 95 mole% helium was directed to a curved Laval nozzle with a nozzle pressure of 88 torr. The nozzle consists of a deflection wall with a curvature radius of 1.5 mm and an eccentrically arranged cylinder with a width of 0.40 mm at the narrowest point. The gas mixture expands in the nozzle to a pressure of 16 torr. At the point where the flow leaves the deflection wall, there is a blade which separates the light from the heavy fraction. Samples of the isotope mixtures were taken from the closed circuit and analyzed by mass spectrometry. The pressures were maintained by means of a Roots compressor. The results showed that a change in the position of the separating blade by 0.01 mm changed the UF6 separation ratio from 0.50 to 0.58. The separation ratio is defined as (Nm/No)(No - Nk)/(Nm - Nk)) where No, Nm, and Nk are the UF6 mole fractions of the gas before separation in the light and heavy fractions, respectively. Details of the welded nozzles made of steel and of the o-ring seals, lubricants, and cooling methods are given. The system operated for 1100 hrs without impairment of performance.

5957 APTIC NUMBER 15093

Schuftan, P. M.
EXTRACTION OF HELIUM, NEON AND HYDROGEN. Chem. Process Eng., 48(4):59-60, 66, April 1967. 30 refs.

Helium and hydrogen, and to a lesser extent, neon, are obtained industrially from gas mixtures at high purities which allow subsequent liquefaction. Sources of the gases are reviewed and various methods for their separation and purification are discussed. The presence of hydrogen in technical gas mixtures originates in the chemical decomposition of water and/or hydrocarbons. A convenient source for relatively small amounts of hydrogen is ammonia. Natural gas is the only source for large quantities of helium, while atmospheric air is the only source of significant quantities of neon. The recovery of hydrogen, neon, and helium from industrial gases is a two-stage process, stage 1 leading to a crude product of about 95% purity in the case of hydrogen and of about 60% or more in the case of neon and helium. Stage 2 then leads directly to a product sufficiently pure for liquefaction. All three gases have low boiling points, making it possible to remove the bulk of the accompanying impurities, which all have higher boiling points, by fractional condensation at gradually decreasing temperatures. For the recovery of neon from air, a crude product with about 60% (Ne plus He) can be withdrawn from a heat exchanger. In stage 2, products with higher purities are obtained by adsorption or absorption at low temperatures of the residual impurities or by permeation at high temperature and pressure. The adsorption process is a batch process and is used for relatively small capacities; it is especially suitable for helium purification. The absorption process is suitable for large-scale hydrogen extraction plants. Recovery of hydrogen or helium by permeation produces gases of ultra-high purity. The process is also suitable for the separation of helium from neon/helium mixtures as obtainable in air-separation plants.

5958 APTIC NUMBER 14559

Schuhmann, R., Jr. and O. W. Moles
SULPHUR ACTIVITIES IN LIQUID COPPER SULPHIDES. J. Metals, 3(3): 235-241, March 1951. 10 refs.

An equilibrium study was made of the reaction Cu2S plus H2 yields Cu plus H2S at temperatures of 1150, 1250, and 1350 C for liquid copper sulfides ranging in composition from saturation with Cu to about 21.5% S. The experiments consisted of finding the ratio of the partial pressure (P) of H2S to the partial pressure (P) of hydrogen in a gas mixture in equilibrium with the melt. Equilibrium was established by bubbling the gas mixture through the liquid and adjusting the gas composition until no reaction occurred. The equilibrium partial pressures of S2 gas were calculated from the p H2S/p H2 data, using Kelley's free energy equation for the dissociation of H2S. The sulfur pressures (p S2) of liquid copper sulfides were found to be very sensitive to composition, especially as the S contents were increased beyond Cu2S. The large increase in p S2 due to a slight increase in S above Cu2S accounts for the well-known fact that artificial preparation of Cu2S involving melting in open containers always gives products close to Cu2S in composition. The p S2 of liquid copper sulfides increases with increasing temperature. This increase is more marked for liquids below Cu2S in sulfur content. The results of the sulfur contents of the liquid copper sulfides saturated with copper agree with Jensen's determination but disagree with earlier data which indicated larger solubilities of Cu in Cu2S. The results also furnished a new determination of the location of the curve showing the compositions of Cu-saturated sulfide melts in the Cu-S constitution diagram.

5959 APTIC NUMBER 14867

Serravalle, G. and G. Coccia
RESEARCH ON THE ELECTROCHEMICAL BEHAVIOR OF THE MOLTEN SYSTEMS CD/CDCL2 + CD/CD AND CD/CDCL2 + KCL + CD/CD. (Recherches sur le comportement electrochimique des systemes fondus Cd/CdCl2 + Cd/Cd et Cd/CdCl2 + KCl + Cd/Cd). Text in French. Electrochim. Acta, 8(5):301-312, 1963. 27 refs.

The electrochemical behavior of cadmium in a molten electrolyte (CdCl2 and CdCl2 + KCl) saturated with cadmium was studied in symmetrical systems. The electrolyte process was found to take

place without appreciable irreversibility. Under special conditions, passivation phenomena appear at the anode, and oscillatory phenomena of current and potential appear at the cathode, associated with its pulsation. Modification of the solution composition due to the passage of current, produces very high concentration polarization but only at the anode. The conditions for the setting up and of the elimination of concentration polarization were studied. A cell altered by the passage of current can, on short circuit, return an appreciable portion of the charge received. (Author abstract modified)

5960 APTIC NUMBER 18603

Shelef, M.
CATALYTIC REDUCTION OF NITRIC OXIDE. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 97-112. 28 refs.

A method was sought for the selective heterogeneous reduction of nitric oxide in the presence of excess oxygen. The decomposition rate of NO on a series of catalysts was studied in a conventional flow apparatus using NO as such or diluted with He. It was concluded that the decomposition reaction is too slow for practical application. The reduction of NO by CO was studied in the same flow system and used a mass-spectrometric technique. The hypothesis advanced is that the limiting stage of the oxidation mechanism with the participation of NO differs from that with O2. With O2 as the oxidizing agent, the rate-limiting catalyst-oxygen bond scission occurs during the reduction of the catalyst. In the oxidation with the participation of NO, the slow step may be the re-oxidation of an active site involving the accomodation of the nitrogen atom. The formation of the N-N bond is postulated, which for the formation of N2 requires the presence of a pair of NO molecules situated in close proximity. The requirement of the formation of the N-N bond may explain why the re-oxidation step of a surface site by NO could be a low probability event. The accepted view of NO chemisorption is through the nitrogen end of the molecule undergoing a surface rearrangement for the oxidation of a reduced surface site. The appearance of N2O is observed when passing NO on a reduced surface in the absence of CO, which supports the role of the N2O as an intermediate in the overall process. This hypothesis, which assumes the interaction of NO with the reduced surface as being the limiting process, explains the preferential participation of oxygen in the oxidation of CO when competing in this reaction with NO. It also explains the absence of the correlation between the surface-oxygen bond strength and the catalytic activity sequence in the CO-NO reaction, which is Fe2O3, Cu2O, Cr2O3, NiO, Co3O4, MnO, V2O5 in the order from most active to least active. This is out of the pattern observed in reactions where oxygen is the oxidizing agent.

5961 APTIC NUMBER 18658

METHOD FOR THE REGENERATION OF A SULFUR DIOXIDE ACCEPTOR WHICH CONSISTS PRIMARILY OR COMPLETELY OF COAL. (Werkwijze voor de regeneratie van een zwaveldioxyde-acceptor die voornamelijk of geheel uit kool bestaat). Text in Dutch. (Shell International Res. Co., The Hague) Dutch Pat. 294,858. 6p., April 26, 1965. (Also: Belgian Pat. 669,971, Jan. 8, 1965.) (Appl. July 3, 1963, 11 claims).

Coal may be used as an acceptor for SO2 and it can be regenerated, but during regeneration, that portion of the carbon required for the reduction of SO2 is lost as carbon dioxide. According to this invention, the carbon (as activated charcoal, lignite, coke, etc.) is recovered by means of a reducing gas or gas mixture. With relatively low regeneration temperatures, SO2 is the main product, along with some H2S; with high regeneration temperatures, H2S is the main product, along with some SO2. Between these two extremes, the ratio of SO2/H2S can be chosen so that this mixture becomes an input for Claus installations for the production of sulfur. A temperature in the range of 300-500 C is recommended. The regeneration rate can be increased considerably by addition of steam to the reducing gas. The use of methane, methane-containing gas mixtures, or natural gas is preferred. The invention is particularly suitable for continuous removal of SO2 and/or SO3 from gas mixtures.

5962 APTIC NUMBER 15825

Shinada, Toshio and Akira Ohnuki
A CRYSTAL OSCILLATOR IN THE FORM OF A CONVEX, PREFERABLY BICONVEX, LENS. (Kristallschwinger in Form einer konvexen, vorzugsweise bikonvexen Linse). Text in German. (Tokujiro Ando, Tokyo) W. German Pat. 1,248,250. 7p., July 13, 1967. 2 refs. (Appl. April 8, 1960, 2 claims).

A crystal oscillator was devised in the form of a convex or preferably biconvex lens. The oscillator should help to suppress unwanted harmonics. The oscillator is characterized by thickness-shear of the second and third order annular oscillations which are excited by electrodes. For exciting second-order oscillations, the electrodes have an outer diameter of 0.78 to 0.83 times the outer diameter of the crystal, D and an inner diameter of 0.15 to 0.30D. For exciting third-order oscillations, the electrodes have an outer diameter of 0.65 to 0.75D and an inner diameter of 0.22 to 0.30D. On diametrically opposed positions, lead contacts are attached.

5963 APTIC NUMBER 15238

Shtern, V. Y.
MECHANISM OF THE VAPOUR-PHASE NITRATION OF ALKANES BY NITROGEN PEROXIDE. Khim. Kinetika, 1966:286-327. 33 refs. Translated from Russian. Ministry of Technology, Orpington, Kent, England, CFI Reports Centre, MINTECH T 6031, 30p., Feb. 1969.
PDC: AD 689718

To determine the optimum conditions for obtaining nitro products by the nitration of alkanes, the kinetics and mechanism of the

thermal nitration of methane and propane were studied. A glass vacuum apparatus with a conventional cylindrical reactor was used for the experiments in which slow reactions, cold-flame, and hot-flame reactions were observed. Only nitromethane, carbon oxides, hydrogen, and water were found in the products of the slow reaction of methane nitration. In addition to these products, the cold-flame reaction yielded formaldehyde and ethane. The hot-flame reaction lead to the appearance of ethylene and to an increase in the ethane and hydrogen content. The main products of the slow reaction of propane nitration were nitro-alkanes and carbon oxides. Methane and hydrogen were not present. The main products of the cold-flame reaction were carbon oxides, olefins, formaldehyde, and methane. The hot-flame reaction decreased the yield of alkenes and carbonyl compounds, increased the carbon oxides, and yielded hydrocyanic acid. The mechanism of alkane nitration is a branching chain reaction that can simulate an unbranching chain reaction when chain discontinuity predominates over the branching. Chain formation is linked with the formation of excited alkyl nitrite whose almost instantaneous decomposition, with the formation of the alkoxyl radical RO, makes possible the further development of the chain. Branching is a result of the reaction of aldehyde with NO2. Instead of the formation of two or three free valencies, the formation of the active acyl radical, RCO, occurs in the course of branching.

5964 APTIC NUMBER 18990

Simpson, Maurice H. and David Askin
PROGRAM STATUS OF ENVIRONMENTAL CRITERIA AND SIMULATION METHODS RESEARCH. Dept. of the Army, Philadelphia, Pa., Frankford Arsenal, Rept. R-1901, DA Proj. 1V025001A622, 69p., Dec. 1968. 39 refs.
CFSTI: AD 684353

Progress reported in transposing natural climatic effects and influences on material performance into realistic criteria for design and laboratory testing of Army material. Major breakthroughs described are related to existing standards and engineering and testing practices. Research activities consisted of establishing parameters and measurements of environmental hazards which form the basis for prediction, analysing of data trends to establish characteristics which are valid for prediction purposes, providing predictions for use at test levels, and reviewing of predictions made to establish confidence in predictive capability. Breakthroughs having a major impact on reliability engineering concepts were a reliability prediction for equipment that is specifically related to climate, an environmental factor set in which the environmental situation can be described in three terms, and an environmental predictor which approaches the problem of multienvironmental factors and interactions in an environmental situation. Another breakthrough is an equation which relates ozone concentration in an air mixture with water vapor content. Raindrop sizes were also related to the intensity of rainfall. It was found that the crucial factor in a rainstorm is the wind factor over 20 mph and that the rainfall intensity need not exceed 4 in./hr. This means that to increase the effect of rainfall in testing, wind velocity behind the rain needs to be increased, not rain intensity. Another breakthrough is the establishment of a need for separate criteria and test methods for sand and for dust, which is contrary to existing practice. Since the program is only 30% completed and there have already been major breakthroughs, the projection of these achievements indicates an even greater acceleration in the rate of progress as the program continues. (Author summary modified)

5965 APTIC NUMBER 15530

Singer, J. M., N. B. Greninger, and J. Gruner
SOME ASPECTS OF THE AERODYNAMICS OF FORMATION OF FLOAT COAL DUST CLOUDS. Bureau of Mines, Washington, D. C., RI 7252, 26p., April 1969. 23 refs.
CFSTI: PB 184311

The dispersion threshold of monolayers and piles of rock dust, anthracite, and Pittsburgh seam coal dust was investigated in a small wind tunnel simulating a coal mine gallery. The objective of the study was to prevent or limit the formation of flammable dust clouds. The effect of selected variables on entrainment velocity was examined. The mode of entrainment and flow processes in the wake region of dust configurations were recorded by a high-speed camera. The results show that local minimum air velocities required for dispersal are only slightly higher for shallow dust ridges than for dust-particles. Minimum velocities for entrainment of dust particles from smooth glass and coal surfaces increase in the order rock dust, anthracite, Pittsburgh seam coal. The mechanism for dispersal of dust piles depends significantly on dust pile geometry, cohesiveness of dust, bulk density and compaction of dust, adhesive surface, and vibrations perturbing the supporting surface.

5966 APTIC NUMBER 14812

Slinn, W. G. N.
BROWNIAN DIFFUSION OF SUBMICRON PARTICLES IN AIR UNDER NONEQUILIBRIUM CONDITIONS. Battelle-Northwest, Richland, Wash., Pacific Northwest Lab., Contract AT(45-1)-1830, Rept. BNWL-987, 50p., Feb. 1969. 32 refs.

Brownian diffusion of particles with Knudsen number large compared to one was analyzed both in equilibrium and nonequilibrium environments. For air in equilibrium, it is shown using only Newton's laws and the central limit theorem that for specular reflection of the molecules, equipartition is a consequence of the motion. For diffuse reflections, the diffusion coefficient was found to depend upon the temperature of the particle and on the number of molecules reflected diffusely. This illustrates a limitation of the fluctuation-dissipation theorem. The motion of Brownian particles in air that is in thermal and translational nonequilibrium, is influenced by heat flux and viscous stress. A new force is described which is similar to that used to explain the thermophoresis effect but which depends upon the viscous stress. The solution was found to the new Fokker-Planck equation. In the generalized convective-diffusion equation, the diffusion coefficient appears as a second order tensor and contains the influence of the viscous stress tensor on diffusion. There

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are a number of avenues open for future work. It is expected that the more difficult, continuum regime will yield similar results but with Stokes' drag coefficient replacing Epstein's. A host of practical problems exist that can be analyzed with the new convective diffusion equation and tested experimentally.

5967 APTIC NUMBER 15870

Snelling, David R. and Edward J. Bair
DEACTIVATION OF O(1-D) BY MOLECULAR OXYGEN. J. Chem. Phys., 48(12):5737-5738, June 15, 1968. 5 refs.

Measurements of the effectiveness of O2 in the rate of deactivation of O(1-D) by various gases are reported. The data show that O2 has no detectable effect on O(1-D) under the range of conditions studied, placing an upper limit of 2 times 10 to the 8th liter/mole sec on the rate of deactivation of O(1-D) by O2. Analysis of the data presumes that significant ozone decomposition during the first few hundred microsec following flash photolysis of a dilute, low-pressure ozone-inert gas mixture is limited to certain processes. According to the data, O2 behaves as an inert gas. The trend in the data is toward an increase in the O3 decomposed rather than the decrease to be expected if O2 were an efficient deactivator. Experiments were performed to determine the extent to which oxygen photolysis influences the result. The ozone absorbance several seconds after the flash indicates that a small amount of O2 is photolyzed. This could possibly account for a small increment in the amount of ozone decomposed at 300 microsec, but definitely could not be sufficiently extensive to obscure the extent of deactivation of O(1-D) by O2.

5968 APTIC NUMBER 15387

Snow, R. D., C. A. Perry, and R. D. Burnette
FELTMETAL FILTER STUDIES. Gulf General Atomic Inc., San Diego, Calif., Contract AT(04-3)-633, Proj. 901,5813, GAMD-8892, 18p., July 18, 1968.

The effectiveness of sintered metal filters (Feltmetal) for the removal of graphite dust entrained in helium was studied in order to provide information on the performance of the high-temperature filter unit proposed for the Fort St. Vrain high-temperature gas-cooled reactor. Carbon dust might be produced in the reactor system as a result of abrasion of graphite fuel and reflector blocks due to temperature cycling, fuel handling, or control rod movement. Another possible source of carbon dust might be reactions with coolant impurities. The tests included the determination of the filtration efficiency of the Feltmetal material for 1 to 10 micron graphite dust and the measurement of the pressure drop across the filters as a function of carbon dust loading, flow rate, inlet gas pressure, and temperature. The filters were 100% efficient for removal of 1 to 10 micron graphite dust. Pressure drop increased with flow rate and dust loading. Excessive accumulation of graphite dust on the filters could be easily removed by a simple back-purge technique. (Author abstract modified)

5969 APTIC NUMBER 14331

Soong, An-Liang
THE CHARGE ON JETTY PARTICLES ATOMIZED FROM SUSPENSION AND THEIR NEUTRALIZATION IN A TRITIUM DE-IONIZER. Thesis (M.S.), Rochester Univ., Rochester, N. Y., UR-89-1000, 1968, 81p. 12 refs.

One of the most common methods of producing exposure aerosols in the laboratory is by the atomization of a solution or suspension of toxic materials; droplets produced in this way are usually charged. Such suspensions are involved in laboratory experiments to establish maximum permissible concentrations in air for various toxic materials; to have validity, these laboratory exposure aerosols should resemble as closely as possible conditions in industrial environments. Investigations were carried out to measure the charge distribution on insoluble particles produced by atomization of a suspension and to determine the degree to which the charges are neutralized by passage through a tritium deionizer. Detailed description and data of the experimental methods and apparatus are presented, including a description of the charge spectrometer and tritium deionizer, and the theory of particle collection by the instrument. It is concluded that airborne particles produced by atomization of a suspension in distilled water carry a wide range of electrical charges. While some particles are neutral, others carry as many as 1300 electrical charges. The charge distribution of the particles was not symmetrical with respect to polarity. The tritium source discharges most particles which have a large number of charges and significantly reduces the average charge. (Author summary modified)

5970 APTIC NUMBER 15324

Steimel, Karl
DEVELOPMENT TENDENCIES AND FUTURE PROSPECTS OF ELECTRICALLY POWERED ROAD VEHICLES. (Entwicklungstendenzen und Erfolgsaussichten elektrisch angetriebener Strassenfahrzeuge). Text in German. Stadthygiene (Salzgitter/Bad), 20(10): 238-241, 1969.

Problems concerning secondary batter-powered buses are discussed. Such buses must be able to participate in the flow of inner city traffic; thus they must be able to attain a maximum speed of 60 km/hr and a maximum acceleration of 1 m/sec/sec. The power requirement of a 15 ton bus (100 passengers) to cover an average of 800 m between bus stops is 1/2 kwhr. The main equipment of such buses comprises the secondary battery, the motor, and diesel electric generators installed in the vehicle. The specific energy for lead batteries ranges from 20 to 27 whr/kg and from 30 to 35 whr/kg for nickel-cadmium batteries. It is considered very likely that in several years a specific energy of 40 whr/kg can be achieved. The life expectancy of a lead battery is presently several hundred cycles. Up to the present, series commutator motors were used exclusively. The externally controlled motor is in the experimental stage. Thyristors are increasingly used for the control of the motor. It is estimated that 20% of the gross weight of the bus consists of the motor and

the secondary battery. At a specific energy of 40 whr/kg, the storage capacity is 100 kwhr. Thus, 80 km could be spanned by such a bus.

5971 APTIC NUMBER 15088

Stein, Gilbert D.
ANGULAR AND WAVELENGTH DEPENDENCE OF THE LIGHT SCATTERED FROM A CLOUD OF PARTICLES FORMED BY HOMOGENEOUS NUCLEATION. Yale Univ., New Haven, Conn., Dept. of Engineering and Applied Science, Contract Nonr-609(87), Report no. 12, 17p., Dec. 1968. 13 refs.
CFSTI: AD 692227

Details of the features of light scattering from ice particles formed by condensation by homogeneous nucleation are presented. An argon laser was used, and the data from the scattering experiments were self-consistent and followed the Rayleigh scattering law. The experiment on wavelength dependence gave the expected result, but the range of wavelengths should be greater for better reliability. The spread in the distribution functions is an indication of the magnitude of error to expect as a result of not knowing the exact size distribution. The important quantity for comparison with nucleation theories is the cluster concentration. The difference due to the distribution used was not significant compared to uncertainties which arise in the theory. An advantage of the argon laser, as distinguished from the helium-neon laser, is that it has several lines in the visible region of the spectrum. In addition, the angular measurements are easier to perform with the flow outside of the laser cavity. There is little sacrifice in signal by not working within the cavity. This is due to three factors: the shorter wavelength of the argon laser enhances the cross section by a factor of three, the photomultiplier tube has about ten times the quantum efficiency at the shorter argon wavelength, and the average power output of the argon laser is at least three times that of the helium-neon laser.

5972 APTIC NUMBER 15003

Straubel, Harald
DETERMINATION OF THE CHARGE DISTRIBUTION OF SURFACES BY MEANS OF STABILIZED, ELECTRICALLY CHARGED PARTICLES. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(12):5-9, Dec. 1968. 8 refs.

A method is developed whereby charge distribution is determined by means of stabilized, electrically charged particles. Individual charged particles, whose charge-to-mass ratio was known, were used. Such particles can consist of polystyrene spheres which are caused to move across a correspondingly charged surface. Such particles can occur also in the form of a concentrated jet issuing from a highly charged nozzle. Since the particles are charged, they are repelled by the plate of the same charge situated below, making it possible to deflect the charged particles in successive electric fields. By this method, the charged particles, which are stabilized in alternating fields, are moved over the surface as the electrometers. The deflections of the particles from the path show the charging conditions of the surface. This method can be extended to all measurements in which charge and mass must be determined separately. It is not restricted to macroscopic particles, but can be applied to very small particles, even ions.

5973 APTIC NUMBER 14885

Streicher, J. S.
THE CATALYSIS OF SO2 TO SO3. Chem. Met. Eng., 37(6):501-502, Aug. 1930.

The use of vanadium as a catalyzer in the sulfuric-acid process is discussed as a substitute for platinum. At low flow rates vanadium achieves the same conversions as platinum at given temperatures. The problem with vanadium is reaching the high rate at which the gases can be combined independently of the percentage yield. The joint action of the two factors, highest flow rates and highest conversions, is the decisive point of every contact plant. The elimination of platinum and the substitution of vanadium compounds and other catalytic compounds has an important economic aspect. In 1930, 1 kg of platinum cost $1286 and 1 kg of vanadium cost $7. The amount invested in platinum can be overlooked, considering that the additional cost of patented apparatus, machinery, license fee, and depreciation always offsets the investment. The high return value of platinum is often in calculations. Moreover, platinum does not cost 'two thousand times as much as vanadium', the true proportion of the cost of vanadium to platinum in July 1930 was 1:188.

5974 APTIC NUMBER 15057

Strnad, J.
SEPARATION IN CENTRIFUGE-MODEL. Appl. Sci. Res. Sect. A., 10(5):307-310, 1961. 8 refs.

Gas centrifuge models previously used for isotope separation had cylindrical rotors. Because of the equality of relaxation times for diffusion and gas motion, and the pressure-dependence of the diffusion constant, the time-dependent equation for a cylindrical centrifuge was complicated. A simple centrifuge model where gas motion does not have to be considered is derived. The theoretical maximum peripheral velocity for this model is up to the square root of two times higher than for a cylindrical rotor. (Author abstract modified)

5975 APTIC NUMBER 14350

Stubbs, Clifford Morgan
THE ACTION OF SULPHUR DIOXIDE ON COPPER AT HIGH TEMPERATURES. J. Chem. Soc., 103(part 1):1855-1861, 1913. 5 refs.

Sieverts and Krumbhaar found that the solubility of sulfur dioxide in molten copper was proportional to the square root of the pressure of the gas; they were unable to decide whether or

not the gas dissolved monatomically. Believing that measurements of the depression point of copper by dissolved SO2 would illuminate the issue, they proposed further investigations of the solubility of nonelementary and monatomic elementary gases. This was undertaken by the present investigators in a series of experiments in which bubbling streams of sulfur dioxide, hydrogen, nitrogen, and carbon dioxide were passed through copper contained in a sealed porcelain pot. Results show that the depression of the freezing point of copper by SO2 is more than double, but not triple, that which would take place if the gas dissolved as simple molecules. Sulfur dioxide dissolved in molten copper consists only partly of unchanged molecules (about 70% at atmospheric pressure reacting to form sulfide and oxide). Supplementary experiments confirmed the hypothesis of a partial combination of SO2 dissolved in molten copper. A complete reaction would give three times the depression calculated from the formula SO2, and the amount of gas would vary as the cube root of the pressure. Sieverts and Krumbhaar's assumption that the square root law is incompatible with the partial reaction theory is shown not to hold if the reaction in the solution under atmospheric pressure is about 70% complete. Under this condition and in agreement with the author's determined value, a partial reaction will give a depression of 2.8 times that calculated for the formula SO2. High values of the equilibrium pressure of SO2 in the univariant system copper, cuprous oxide, cuprous sulfide, and sulfur dioxide at 1050 deg and 7 atm pressure explain its insolubility at high temperatures and ordinary pressures.

5975 APTIC NUMBER 15325

Suchkov, A. P., P. A. Porok, and Z. I. Morozova
THERMAL DECOMPOSITION OF A MIXTURE OF MnSO4 + FeSO4 IN A FLOW OF STEAM. (O termicheskom razlozhenii smesi MnSO4 + FeSO4 v toke vodyanogo para). Text in Russian. Zh. Prikl. Khim., vol. 32: 1618-1620, May-Aug. 1959. 8 refs.

It was established experimentally that the decomposition of ferric sulfate in a flow of steam of 500 C yields high-quality ferric oxide and regenerates a significant quantity of sulfuric acid of 96% concentration. Decomposition of a mixture of ferric sulfate and manganese sulfate in a flow of steam at 600 C followed by washing of the solid product with water yields ferric oxide free of manganese impurities.

5977 APTIC NUMBER 15416

Suchkov, A. P., P. A. Porok, and Z. I. Morozova
THERMAL DECOMPOSITION OF CERTAIN SULFATES IN A FLOW OF STEAM. (O termicheskom razlozhenii nekotorykh sul'fatov v toke vodyanogo para). Text in Russian. Zh. Prikl. Khim., vol. 32: 1616-1618, May-Aug. 1959. 2 refs.

Thermal decomposition at 200-1000 C in steam was studied using sulfates of lithium, sodium, potassium, copper, beryllium, magnesium, calcium, aluminum, titanium, chromium, manganese, iron, cobalt, and tin. It was demonstrated that decomposition of certain sulfates under these conditions is an effective process for obtaining sulfuric acid and corresponding oxides and that it proceeds at much lower temperatures than ordinary thermal decomposition. A bond-theory explanation is given for differences in decomposition temperatures among these sulfates.

5978 APTIC NUMBER 15056

Sucov, E. W., J. L. Pack, A. V. Phelps, and A. G. Engelhardt
PLASMA PRODUCTION BY A HIGH-POWER Q-SWITCHED LASER. Phys. Fluids, 10(9):2035-2048, Sept. 1967. 43 refs.

Studies were made of the confinement in a magnetic mirror of plasmas produced by focusing a Q-switched laser beam on aluminum disks, foils, and spheres. High speed photographs show that, in the absence of a confining magnetic field, the plasma generated from ball targets is roughly symmetrical while one component of the plasma generated from flat targets is asymmetric and moves toward the laser with a velocity of about 10 to the seventh cm/sec. A second component, which is more nearly symmetric, expands with a velocity of approximately 2 times ten to the sixth cm/sec. The expansion velocities are not appreciably reduced in a 14-6-14 kG mirror field. However, the duration of the luminosity from a slower constituent of the plasma increases from 1 microsec to about 5 microsec microwave interferometer measurements show an electron density of about 5 times 10 to the eleventh reciprocal cm at times as late as 50 microsec. Electrostatic probes verify that the maximum expansion velocity corresponds to an ion kinetic energy of about 1.8 keV. Time integrated spectra of the plasma show lines from Al(III). Microwave attenuation measurements lead to an apparent electron temperature of the order of 0.03 eV at times later than 1 microsec. Analysis of microwave data shows that radial density gradients probably exist in some plasmas. (Author abstract modified)

5979 APTIC NUMBER 13720

Sunshine, Irving, Nicholas Rodnett, C. P. Hall, and Fredric Rieders
DRUGS AND CARBON MONOXIDE IN FATAL ACCIDENTS. Postgrad. Med., 43(3):152-155, March 1968. 16 refs.

Experiments were conducted on the way in which alcohol alone, a drug, alcohol in combination with a drug, and a placebo affect the perception, behavior, coordination and overall skill of drivers. These experiments gave minimal information about blood concentrations of these drugs. The results of analyses of blood and urine specimens obtained from persons killed in vehicular accidents in Philadelphia and Cuyahoga County, Ohio are discussed and the data related to this problem are provided. Persons who survived more than 12 hours or were less than 15 years of age were excluded from this study. Postmortem blood samples were obtained from each victim and analyzed for alcohol and other volatiles, carbon monoxide, barbiturates, meprobamate, and glutethimide. Whenever possible, urine samples were analyzed for salicylates, phenothiazines, glucose, acetone, and organic bases including amphetamine. The data corroborated previous findings that ingestion of alcohol

is a significant factor in vehicular accidents. Glutethimide and meprobamate, widely used prescription drugs, were not detected in blood samples of any of the victims. Barbiturates were present in only two of the specimens obtained, and it was difficult to determine how much they contributed to the accident. Salicylates of phenothiazines were not detected in the urine samples. Glucose test results indicated that uncontrolled diabetes did not contribute to the accidents.

5980 APTIC NUMBER 14763

Sutugin, A. G.
THE SPONTANEOUS CONDENSATION OF VAPOURS AND THE FORMATION OF CONDENSATION AEROSOLS. Russ. Chem. Rev. (English translation from Russian of: Usp. Khim.), 38(1):79-93, 1969. 191 refs.

A critical examination is presented of the modern theories of spontaneous condensation, experimental methods of study, the relationship between theory and experiment, and methods for calculating the microscopic model of aerosol formation. The theory of spontaneous nucleus formation is based on a model in which a supersaturated vapor consists of a mixture of single molecules and molecular aggregates which are regarded as the nuclei of a new phase. The difficulty of calculating the free energy of formation of the nuclei of a new phase is examined in detail, and particular attention is paid to the problem of the contribution made by external degrees of freedom to the free energy. The problem of the existence of limiting supersaturation is discussed. Existing methods for the study of spontaneous condensation and the results that were obtained by these methods are examined. In summarizing the examination of the results of the experimental study of spontaneous condensation, it was concluded that the experimental data confirmed the classical Volmer-Frankel-Becker-Doring-Zel'dovich theory rather than the new Lothe-Pound-Wirth theory. It was also stated that existing methods for calculating the processes of aerosol formation using the equations of the theory of spontaneous nucleus formation make it possible to predict the parameters of the resulting aerosols with sufficient accuracy for practical purposes.

5981 APTIC NUMBER 15912

Suzdalev, I. P., A. V. Shkarin, and G. M. Zhabrova
STUDY OF THE REACTIONS OF CARBON MONOXIDE AND CARBON DIOXIDE WITH THE SURFACE OF AN Fe2O3 CATALYST FROM MOESSBAUER SPECTROSCOPIC DATA. Kinetics Catalysis (USSR) (English translation from Russian of: Kinetika i Kataliz), 10(1):179-181, Jan.-Feb., 1969. 8 refs.

The catalytic oxidation of carbon monoxide to carbon dioxide over iron oxide was investigated with a Moessbauer spectroscope and by kinetic and sorption measurements. The kinetic studies show that 80-150 C chemisorption of CO on Fe2O3 is accompanied by formation of CO2. At the same temperatures the chemisorption of CO2 proceeds at a high rate. In general, after admitting the first portion and subsequently freezing out, part of the CO2 remains on the surface of the catalyst. After catalytic oxidation of CO and freezing out the CO2, the nature of the Moessbauer spectrum is unaltered; if CO2 is not frozen out during oxidation, new lines appear on the spectrum. These same lines appear after the chemisorption of CO2 on the surface of Fe2O3. The lines formed by the reaction of CO with the surface of Fe2O3 are different from those appearing during chemisorption of CO2. After CO has reacted with the catalyst, a bivalent iron cation appears that is bound to the surface of the catalyst; its valency state is not altered by heating to 100 C. The bivalent cations form a compound of the type FeO. In contrast, the adsorption of CO2 on Fe2O3 produces surface iron carbonates with appreciable fractions of covalent bonding.

5982 APTIC NUMBER 14879

Szargan, Peter
ON THE OXIDATION KINETICS OF SOOT. (Zur Kinetik der Oxydation von Russ). Text in German. Chem. Techn. (Berlin), 21(8): 460-461, Aug. 1969. 5 refs.

A kinetic equation for the oxidation of soot by CO2 and steam was derived and solved. The specific surface of the soot was found to be 173 sq m/g, the activation energy 59 kcal/mole. The specific surface measured by adsorption of nitrogen and iodine was found to be 885 sq m/g. Apparently, only a fraction of the surface is accessible to oxidation. Experimental results obtained in several plants for gasification of liquid hydrocarbons with steam and oxygen agree well with the theoretical calculations. They show that during gasification, a constant amount of soot is formed which is variously oxidized, depending on reaction conditions.

5983 APTIC NUMBER 14741

Takashima, Y., A. Kanagawa, and Y. Ovama
ISOTOPE SEPARATION BY CONCURRENT GAS CENTRIFUGE. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 3rd, Geneva, 1964, vol. 12:352-355. 13 refs.

Isotope separation by the concurrent gas centrifuge method is discussed. The basic equations for the concurrent type of centrifuge are given. The separation performances by concurrent and countercurrent flow were compared. Analytical calculations showed that the countercurrent type of centrifuge is superior in separation performance. However, the requirement for a circulation device which will control a moderate circulation flow rate and give a suitable flow pattern cannot be fulfilled unless the mechanical and material problems are solved. A slightly better performance can be obtained from the concurrent centrifuge by using several streams instead of two streams. The effect of stream thickness, which makes it difficult to analyze the separation performance, will not be detrimental, as the mixing of the inner two thin streams gives better performance than a single inner stream.

5984 APTIC NUMBER 14718

Talina, T.
CATALYTIC PROPERTIES OF Fe(OH)3 IN THE OXIDATION OF SO2 TO SO3 BY ATMOSPHERIC OXYGEN. (Kataliticheskiye svoystva Fe(OH)3 v protsesse okisleniya SO2 v SO3 kislorodom vozdukha). Text in Russian. Zh. Fiz. Khim., 9(3):421-430, 1937. 6 refs.

It was determined experimentally that Fe(OH)3 exhibits greatest catalytic activity at 125-130 C, optimum flow rates being established at 250 cc/hr for SO2 and 2.5-3 l/hr for air. Pumic and gauze proved to be equally effective substrates under these conditions; asbestos wool and BaSO4 paper proved less effective. Catalytic activity was observed to drop after 10 min. Findings were not adequate to determine the practicability of using Fe(OH)3 on an industrial scale for the conversion of SO2 to SO3.

5985 APTIC NUMBER 15923

Thomas, W. J. and Usman Ullah
CHEMISORPTION OF HYDROGEN SULFIDE AND CARBON DISULFIDE ON SULFIDED NICKEL OXIDE AND VANADIUM PENTOXIDE. J. Catalysis, 15(4):382-394, 1969. 17 refs.

The adsorption of both hydrogen sulfide and carbon disulfide on sulfided nickel oxide and vanadium pentoxide was studied, using a volumetric technique. Equilibrium measurements for H2S at 500 to 650 C and for CS2 at 55 to 200 C indicated that a Langmuir model is adequate for interpreting the adsorption and desorption characteristics of both systems. Much larger quantities of H2S are adsorbed than either CS2 or S2. This is explained in terms of the geometry of the adsorbent and the disposition of molecular orbitals of the adsorbate. Semiempirical calculations based on the absolute rate theory showed that a model in which the adsorbed complex is completely mobile is most satisfactory. The sulfur exchanging properties of sulfided nickel oxide and vanadium pentoxide are shown to bear a relation to the efficacy with which these materials can be used as catalysts for the formation of CS2 from methane and sulfur. Rate measurements of the adsorption of sulfur and the desorption of CS2 give further support to the hypothesis that surface reaction between adsorbed sulfur and either gaseous or physically adsorbed methane is the rate-determining process during CS2 synthesis. (Author abstract modified)

5986 APTIC NUMBER 15139

Tiffany, W. B.
SELECTIVE PHOTOCHEMISTRY OF BROMINE USING A RUBY LASER. J. Chem. Phys., 48(7):3019-3031, April 1, 1968. 46 refs.

Gas-phase photochemical addition of bromine to olefin molecules was studied by inducing the reaction with monochromatic light near 6980 A from a pulsed, tunable ruby laser. All previous photochemical reactions of bromine were induced with light at wavelengths shorter than 6800 A, and were found to proceed by means of free radical chains. The Br atoms initiating these chains are produced by direct dissociation of Br2 molecules upon absorption of light in the continuum. The present investigation shows that free-radical chains are responsible for the reaction at 6980 A, also. However, direct dissociation at this wavelength is found to be negligible, and the Br2 molecules are excited to individual bound levels 500 to 800/cm(-1) below the dissociation energy. Kinetic and isotopic evidence shows that the additional energy is furnished by subsequent collisions, so that about 1% of the excited Br2 molecules become dissociated and can initiate the reaction. The remaining excited Br2 molecules relax by collisions to the ground state at a rate somewhat higher than the gas-kinetic-collision rate. It was shown that selective laser excitation provides information about dynamic molecular processes which is not easily obtained using other methods. (Author abstract modified)

5987 APTIC NUMBER 15539

Town, Joseph W., Philip F. Sanker, and Hal J. Kelly
ALKALIZED-ALUMINA ATTRITIONING AND SO2 SORPTION RATES. Bureau of Mines, Washington, D. C., RI-7275, 29p., July 1969. 7 refs.

The Bureau of Mines conducted studies related to sulfur dioxide air pollution to determine attritioning rates, SO2 sorption rates, and sulfur loads that could be obtained on commercial alkalized alumina sorbent pellets. Fluidized-bed attritioning rates ranged from 1.025%/hr for alkalized alumina with a crushing strength of 4 kg to 0.075%/hr for 0.5 kg crushing strength material. Airlift attritioning rates ranged from 0.50%/hr for 3 kg crushing strength alkalized alumina to about 3%/hr for 0.5 kg material. Attritioning rates for the commercial alkalized alumina were comparable to those obtained for sorbent pellets prepared in the Bureau of Mines laboratory. Sorption rates were related to SO2 concentration in flue gas, temperature, and presence of nitrogen oxides in the gas stream. Sorption rates at 300 C were 0.35 times 10 to the minus fifth power grams sulfur per gram pellet per second (gS/gp/sec) in 0.085% SO2 gas; 5.1 times 10 to the minus fifth power gS/gp/sec in 0.3% SO2 gas; and 65 times 10 to the minus fifth power gS/gp/sec in 10% SO2 gas. For the 0.3% SO2 gas, sulfur loads of 0.10 gS/gp (the projected load for regeneration) were obtained in 47 min at 130 C and in 116 min at 300 C. The presence of either NO or NO2 in the 0.3% SO2 gas increased the SO2 sorption rates two to three times at 300 C, but had no effect at 130 C. (Author abstract)

5988 APTIC NUMBER 14928

Trolinger, J. D., R. A. Belz, and W. M. Farmer
HOLOGRAPHIC TECHNIQUES FOR THE STUDY OF DYNAMIC PARTICLE FIELDS. Arnold Engineering Development Center, Arnold Air Force Station, Tenn., Contract F40600-69-C-0001, Project 8219, Task 821907, AEDC-TR-68-215, 26p., Nov. 1968. 6 refs.
CFSTI, DDC: AD 678 858

Studies dealing with the determination of sizes, densities, and velocity fields associated with dynamic particle arrays are discussed. A wavefront characterizing an object and a reference wave to interfere with the object wave at the surface of a photographic plate are needed to produce a hologram of the object. The in-line hologram of a small particle is described theoretically and experimentally. It is shown that when an image is constructed

from an in-line hologram, a new hologram is formed, in addition to the image, and is superimposed upon the image. This secondary hologram is of dust particles in the reconstruction system, plus any information stored on the primary hologram and all out-of-focus images. The determination of particle sizes, shapes, and densities can be made by direct observation of the reconstructed image. A limitation is that increased particle number density and velocity cause poor holograms. Also, as the particle size decreases, it must be nearer to the hologram in the original construction. Many of the usual photographic techniques can be extended to include motionpicture and stroboscopic holography. A new hologram can be made at different time intervals and the various three-dimensional images superimposed to study motion of the elements during the intervals. The Q-switched ruby laser represents the present limit in high power and short exposure. Multiple exposure can be accomplished by using several lasers synchronized to fire at the desired levels. Double exposure can be applied successfully to electrolysis, bubble formation, water jets, and other arrays of scattering centers. It also shows promise in the study of seed and contaminant materials, in various types of flows, in the study of rocket exhausts, chemical reactions, impact, and other dynamic phenomena.

5989 APTIC NUMBER 15927

Varlamov, M. V., P. L. Krichevskaya, A. A. Pan[illegible] L. M. Zampol'skaya, G. A. Manakin, and M. A. Georgali:
ACOUSTIC COAGULATION OF MIST CONTAINING FLUORINE COMPOUNDS. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 41(11):2494-2499, Dec. 1968. 8 refs.

The efficiency of acoustic coagulation of aerosols containing fluorine compounds has been previously studied by chemical determinations of fluride contents before and after coagulation. In the present study, efficiency of sonic treatment was assessed by ultramicroscopic determinations of particle numbers per unit aerosol volume (number concentration) and both ultramicrosopic and photomicrographic determinations of particle size distribution. Determinations of particle number concentrations was made before and after acoustic coagulation of waste gas aerosols from a superphosphate granulation plant. The results show that the number of particles decreases by a factor of 100-1000 as the result of acoustic treatment for 3-5 sec. The results of determinations of particle size distribution before and after acoustic treatment are presented in the form of histograms and distribution curves. The form of the histograms suggest a Gamma-distribution. With the industrial mist, the number of particles deposited per unit area decreased by a factor of 125 after acoustic treatment for 1.5 sec, while the average diameter increased from 2.5 to 18.7 micron. Before treatment, 88% of the particles were in the 1-4 micron size range. Accoustic treatment shifts the distribution center to the right and increases the variance. Similar results were obtained from photomicrographs of mists deposited on greased glasses.

5990 APTIC NUMBER 18917

Vasilieva, P. V.
IMMUNOLOGICAL ASSESSMENT OF A MODEL OF EXPERIMENTAL BERYLLIOSIS. (Immunologicheskaya otsenka modeli eksperimental'nogo berillioza). Text in Russian. Byul. Eksperim. Biol. i Med., 67(3):74-77, 1969. 11 refs.

Rats were administered 2.5 mg of berrylliun oxide intratracheally to test their immunological reactivity. The results showed that morphological changes due to berylliosis were accompanied by a skin reaction to soluble berryllium compounds and by the formation of humoral and sessile antibodies to lung nucleoproteins. The immunological activity of the rats resembles that of animals with chronic berylliosis and can serve as an experimental model of chronic berylliosis. (Author summary modified)

5991 APTIC NUMBER 18788

Vignes, Michele
CONTRIBUTION TO THE STUDY OF VERTICAL GAS JETS IN A CALM ATMOSPHERE. (Contribution a l'etude des jets gazeux verticaux dans une atmosphere calme). Text in French. Rev. Gen. Thermique (Paris), 7(83):1205-1217, Nov. 1968. 13 refs.

Vertical jets of gases heavier than the ambient air and at ambient temperature were studied. The gases studied were carbon dioxide, Freon 12, oxygen, and argon. An expression was derived for the height of culmination defined as the height past which the heavier gas will not rise, due to loss of energy by diffusion and viscosity and to the transformation of kinetic to potential energy. The theoretical expression was tested experimentally in an enclosure in the laboratory equipped with a vertical tube to simulate a chimney in an infinite space. In addition, modifications in the shape of the mouth of the vertical tube were studied. A reduction in the diameter of the opening at the top of the vertical tube by 2/3 doubled the height of culmination.

5992 APTIC NUMBER 14898

Watson, J. T. R.
THE P-V-S SURFACE OF CARBON MONOXIDE FOR TEMPERATURES OF 0 TO 150 C AND PRESSURE OF 30 TO 300 MN/SQ. M. NPL Report, 371, 17p., Nov. 1968. 18 refs.

Isentropes of carbon monoxide were computed from Michels' compilation of thermodynamic properties for pressures from 30-300 MN/ sq m and temperatures from 0-150 C. A semi-empirical entropic equation of state was fitted to the isentropes; the coefficients of this equation were fitted by an iterative numerical method as Chebyshev series expansions in specific entropy. The average deviations in volume between the isentropes interpolated from Michels' compilation and isentropes represented by the Chebyshev series were 0.053%. It is concluded that the semi-entropic equation excellently represents the p-V-S surface of carbon monoxide. Although the coefficients of the equation were derived for carbon monoxide at 0-150 C and 30-300 MN/sq m, it is probable that the same coefficients will provide pV data outside of this region for the specific

entropy range of 1900 to -2340 J/kg deg. (Author conclusions modified)

5993 APTIC NUMBER 15006

Weber, Ekkehard
THE INFLUENCE OF DUST WETTABILITY ON WET SCRUBBING. Staub (English translation from German of: Staub, Reinhaltung Luft), 28(11):37-43, Nov. 1968. 7 refs.
CFSTI: PB 68-50488/11

The relationships between wettability, wetting volume, wetting time, liquid level rise in bulk material fillings, and suction velocities were investigated on glass powders of known wetting behavior. The investigations indicate that the rates of rise and the total wetting times are clearly related to the wetting behavior of pulverulent solids. A connection between the measured values and clearly defined wetting factors could not be established, confirming the complexity of wetting-kinetic processes. The wetting volume appears to be of limited significance in regard to wetting behavior of heterogeneous dusts. Data confirmed that the rates of rise and wetting times differ greatly for individual samples. The assumption that dust difficult to wet cannot be bonded to water was tested. Results show that, regardless of particle type and velocity, a dust particle hitting the water droplet is always retained by the latter, even if the water droplet is greatly deformed by the jet speed. This indicates that the wetting behavior of particles in wet scrubbing of gases for dust removal is of secondary importance.

5994 APTIC NUMBER 18577

Wethern, James D.
METHOD OF PROCESSING SULFATE BLACK LIQUOR TO YIELD METHYL MERCAPTAN AND DIMETHYL SULFIDE. (Riegel Paper Corp.) U. S. Pat. 3,333,009. 2p., July 25, 1967. (Appl. March 22, 1965, 8 claims.)

In addition to improved overall by-product yield, the process of the invention is capable of giving an improved yield of relatively more valuable methyl mercaptan in proportion to dimethyl sufide. At the same time, it affords a desirable measure of control over the relative proportions of the principal by-products. Spent kraft black liquor is initially dried and then homogeneously mixed with elemental or combined sulfur. The mixture is heated in a closed reaction chamber in contact with a flowing stream of heated carrier gases to effect pyrolytic decomposition of the liquor solids. Evolved by-products are continuously removed by the carrier gas, usually nitrogen or superheated steam. Recovery of the sulfur by-products is effected by separation from the carrier gas.

5995 APTIC NUMBER 15038

Whitaker, Stephen
DIFFUSION AND DISPERSION IN POROUS MEDIA. Am. Inst. Chem. Engrs. J., 13(3):420-427, May 1967. 24 refs.

The dispersion equation for a single, nonreacting, nonadsorbing species is derived for incompressible, laminar flow in anistropic porous media. Direct integration of the appropriate differential equations gives rise to a dispersion vector and a tortuosity vector both of which must be evaluated experimentally. For the dispersion vector, this is conveniently done by representing the dispersion vector in terms of the velocity and gradients of the velocity and concentration. The experimental determination of the tortuosity vector is not straightforward except for the case of pure diffusion. The analysis yields a result which contains all the features of previously presented dispersion equations without making any assumptions as to the nature of the flow, except that it be laminar. Attacking the dispersion problem in terms of the differential diffusion equation provides a rational basis for the correlation of experimental data and illustrates the connection between the microscopic and macroscopic equations. (Author abstract modified)

5996 APTIC NUMBER 14993

Whitman, Walter G.
PRELIMINARY EXPERIMENTAL CONFIRMATION OF THE TWO-FILM THEORY OF GAS ABSORPTION. Chem. Met. Eng., 29(4):146-148, July 23, 1923. 2 refs.

The two-film theory of absorption is discussed with attention to its applications. A liquid and gas are in contact with each other from which the solute is being absorbed. Conditions outside the gas film are the same as in the main body of gas, while those at the inside of the liquid film are the same as in the main body of liquid. The gas and liquid are in equilibrium at the boundary between the two films. Absorption occurs through two films in series. Diffusion through the gas film should be determined by a partial pressure gradient of the solute and through the liquid film by a concentration gradient. For acid concentrations up to about 250 g/l, the partial pressure of the acid is negligible. When the surface concentration is below this figure, the acid will absorb gas as rapidly as it can reach the surface, that is the rate of absorption is determined solely by the rate of diffusion through the gas film. At high concentrations of acid, the equilibrium pressure on the surface becomes large and also changes rapidly with the concentration. Consequently, the absorption of a small amount of acid into the surface brings the surface into substantial equilibrium with the gas, thereby preventing absorption until the absorbed acid has diffused through the liquid film into the interior. This rate of diffusion is slow, which explains the fact that for the same pressure gradient, the rate of absorption is far more rapid than in those towers containing strong acid. While experimental data does not prove the truth of the two-film theory, it does show that previously proposed methods are entirely incapable of handling cases of this nature, and that the concept of a single gas or liquid film is permissible only when the relationship between concentration and pressure is approximately a direct

proportion. For more complicated problems, the two-film theory seems fundamentally sound and the preliminary experiments afforded checks as to its validity.

5497 APTIC NUMBER 19518

Whittaker, Colin W., Frank O. Lundstrom, and Albert P. Merz
PREPARATION OF POTASSIUM NITRATE FROM SOLID POTASSIUM CHLORIDE AND NITROGEN DIOXIDE. Ind. Eng. Chem., 23(12):1410-1411, Dec. 1931. 7 refs.

By passing nitrogen dioxide gas through a tower packed with potassium chloride crystals containing 2.8% moisture, nearly complete conversion of potassium chloride to potassium nitrate was accomplished within 3 hrs. After the tower was flushed with oxygen to remove nitrogen-containing gases, the remaining salt had, after drying at 120 C, a nitrogen content corresponding to 92.2% potassium nitrate. As indicated by decided increases in temperature of the tower wall at the reaction zone, the reaction is exothermic. The small amount of water necessary for the reaction suggests that its function may be catalytic, perhaps by taking part in an intermediate reaction. The most complete conversion is obtained by continuing the nitrogen dioxide flow for a time after the reaction zone is passed. Nitrosyl chloride is produced simultaneously.

5498 APTIC NUMBER 15062

Wieder, Irwin and Gregor B. McCurdy
ISOTOPE SHIFTS AND THE ROLE OF FERMI RESONANCE IN THE CO2 INFRARED MASER. Phys. Rev. Letters, 16(17):565-567, March 28, 1966. 11 refs.

Laser action in several P transition of the 00(zero-th angular momentum state)1-10(zero-th angular momentum state)0 and 00(zero-th angular momentum state)1-02(zero-th angular momentum state)0 bands of C(12)02(18) is reported. The contribution of Fermi resonance to the large observed isotope shift and the importance of Fermi resonance to the kinetics of the laser are discussed. The weaker 00(zero-th angular momentum state)1-02(zero-th angular momentum state)0 laser band was observed in a single P transition at 956.5 reciprocal cm for C(12)02(18) and at 1086.0 reciprocal cm for C(12)02(16). Isotope shifts of 33% for the 00(zero-th angular momentum state)1-10(zero-th angular momentum state)0 band were observed; a much smaller effect would be expected if the levels 10(zero-th angular momentum state)0 and 02(zero-th angular momentum state)0 were not in Fermi resonance. The positions of the vibrational levels for C(12)02(18) were calculated. The isotope effect is greater for the unperturbed 10(zero-th angular momentum state)0 level than for the unperturbed 02(zero-th angular momentum state)0 level with the net result that the relative positions of the two unperturbed levels are reversed; the Fermi resonance then repels the levels further apart to their observed positions. The dominant laser bands is the 00(zero-th angular momentum state)1-10(zero-th angular momentum state)0 transition in both C(12)02(18) and C(12)02(16). The method of isotopic substitution is applicable to all known molecular lasers and should provide numerous additional coherent sources of infrared radiation.

5499 APTIC NUMBER 15136

Wiegandt, Herbert F.
MECHANICAL ENERGY IMPROVES DIFFUSIONAL SEPARATIONS. Chem. Eng., 64(8):274-279, Aug. 1957.

The improvement of diffusional separations, especially ion exchange, adsorption, molecular distillation, gas adsorption, and extraction, by the use of mechanical energy to supplement gravity operations in achieving mass transfer, has application in the chemical process industries, where the trend is toward more complex and precise separations. There is an absence of any interface in diffusional separations which take place in a single phase, as in isotope separations; mechanical energy applications to these are still in the future. If there is more than one phase, and if one of the phases is a solid, the surface of the solid represents a fixed interface; here, the application of mixing energy, as with spinner columns in ion exchange, is extremely helpful in improving the mass transfer to the surface of the solid. However, the greatest possibilities for using mechanical devices to aid mass transfer seem to be in the mobile-interface group, particularly for gas absorption with the use of mixing equipment; distillation, which can use centrifugal as well as mixing equipment; and solvent extraction, using centrifugal, mixing, and pulsating equipment. These three types of processes are reviewed in detail, with particular emphasis on mechanical energy used in extraction. Such equipment includes extractors with multi-stage mixers, the Schiebel column which separates the mixing zones with sections of packing, a stacked tray unit involving a mixer-settler arrangement, a pulse column, and centrifugal extractors, used in such processes as the production of antibiotics, solvent refining of lubricating oils, and recovery of aromatics from hydrocarbon fractions.

6000 APTIC NUMBER 15088

Wieland, K.
THERMO-OPTICAL DISSOCIATION OF SULPHUR DIOXIDE. Trans. Faraday Soc., Vol. 30:260-265, 1938. 17 refs.

The absorption spectrum of gaseous sulfur dioxide was photographed in the Schumann region at temperatures up to 45 C. At room temperature, it showed a well-developed band spectrum between 2800 and 1700 A with a predissociation limit at about 1900 A, corresponding to the dissociation into SO and O. The SO2 bands almost completely vanished at 450 C and a pressure of 1.5 mm, and a new spectrum appeared. This consisted of very faint bands between 2800 and 2600 A, due to S2, and a much stronger band system below 1900 A, which also belonged to S2. The SO2 bands reappeared with the same intensity as before heating after recooling the absorption tube. The dissociation of SO2 into 1/2 S2 and O2 might at first be assumed as an explanation; however, this reaction requires 93 cal and can therefore not be so greatly influenced by temperature. The dissociation of SO2 into 1/6 S2 and 4/6 SO3 requiring only 12.6 cal is more compatible with an appreciable thermal influence. Therefore, the results were

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interpreted as the optical dissociation of SO2 into S2 and SO4. (Author abstract modified)

6001 APTIC NUMBER 13809

Williams, Harry D.
CELLULOSE SOLUTIONS IN DIMETHYL SULFOXIDE AND NITROGEN DIOXIDE. Du Pont De Nemours (E. I.) and Co., Wilmington, Del. U. S. Pat. 3,236,669. 3p., Feb. 22, 1966. 5 refs. (Appl. April 19, 1963, 9 claims).

The invention describes the economical preparation of homogeneous solutions of cellulose which can regenerate cellulose products without the use of carbon dioxide or sodium hydroxide. It has applications for the manufacture of textile fibers and transparent films. Solutions are prepared by adding about 1.0-1.7 parts by weight of liquid nitrogen dioxide per part by weight of cellulose to a slurry of cellulose and at least four parts dimethyl sulfoxide per part cellulose until a substantially homogeneous solution is obtained. Preferably, the reaction should be carried out at 20-80 C. Precipitation is effected at an aging temperature below 60 C by dilution in an aqueous medium containing at least 50% by weight of water. The medium can contain sodium chloride, sodium sulfate, magnesium chloride, potassium sulfate, or other dissolved salts. Cellulose esters can be prepared by adding the anhydride of the corresponding organic acid and an optional acidic catalyst such as sulfuric acid, to the solution of cellulose and nitrogen dioxide in dimethyl sulfoxide.

6002 APTIC NUMBER 15180

Wilson, David J.
PHOTOCHEMICAL REACTIONS IN THE GAS PHASE AND SLATER'S 'NEW APPROACH TO RATE THEORY'. J. Chem. Phys., 39(5):1098-1108, March 1, 1963. 9 refs.

Slater's 'New Approach to Rate Theory' is used to mathematically analyze two simple gas-phase photochemical mechanisms in detail. Quantum yields are calculated as functions of pressure, and the qualitative nature of the plots is discussed. Statistical methods are used to develop consistency theorems for checking experimental plots of quantum yield versus pressure against the theory. (Author abstract modified)

6003 APTIC NUMBER 10816

Winter, E. R. S.
THE DECOMPOSITION OF NITROUS OXIDE ON THE RARE-EARTH SESQUIOXIDES AND RELATED OXIDES. J. Catalysis, 15(2):144-152, 1969. 18 refs.

The decomposition of N2O, catalyzed by 15 M2O3 oxides including 11 of the rare earth-C crystal structure, is represented with reasonable accuracy at 10-20 cm by an equation where the desorption of molecular oxygen is an important rate-determining step; this is also the rate-determining step in the isotopic exchange between O2 gas and the oxide surface by a dissociative process on the surface, which was recently measured for this series of oxides. A strong correlation exists between both Ao and E in the Arrhenius expression for the exchange reaction and the corresponding functions for N2O decomposition. Since these functions vary in a regular manner with lattice parameter for the exchange reaction, so too do Ao and E for the decomposition of N2O. No correlation was found for such properties as the magnetic moment of the M(III) ion which do not vary regularly with the lattice parameter. (Author abstract modified)

6004 APTIC NUMBER 15505

Wirtz, K.
ON THE THEORY OF MIGRATION PROCESSES IN LIQUIDS. (Zur Theorie der Wanderungsvorgaenge in Fluessigkeiten). Text in German. Z. Elektrochem., 58(2):109-112, 1954. 10 refs.

Stokes's formula for the velocity of a particle in a liquid was modified by a factor which contains the radii of the molecules of the solvent and of the solute, respectively. Necessary assumptions were that the forces between the solvent and the solute are similar to the forces between the solvent molecules and that the motion of the solute particle does not contain any terms deriving from motion relative to all neighbors. The migration velocity contains terms deriving from place changes and from viscuous flow. After an analytical expression for viscosity from the theory of place changes was derived, the influence of particle properties on friction was discussed. It was shown that Stokes's law and Eucken's law are special limiting cases of a more general law of friction derived from the place change theory.

6005 APTIC NUMBER 18670

Woehler, Lothar, F. Martin, and F. Schmidt
THE FORMATION OF SULFUR BY THE ACTION OF SULFUR DIOXIDE ON CALCIUM SULFIDE, ZINC SULFIDE AND IRON SULFIDES. (Ueber die Bildung von Schwefel bei der Einwirkung von Schwefeldioxyd auf Calciumsulfid, Zinksulfid und die Eisensulfide). Text in German. Z. Anorg. Allgem. Chem., Vol. 127:273-298, 1923. 12 refs.

In a study of the reaction between SO2 and CaS, it was found that the reaction takes place up to 1000 C according to the equation CaS plus 2SO2 yields CaSO4 plus 2S. Above 1000 C, CaO and S are formed (2CaS plus SO2 yields 2CaO plus 3S). The first reaction soon came to a halt due to coating of the CaS by the sulfate. The second reaction went to completion. Addition of calcium oxide and calcium carbonate increased the reaction speed. The reaction between zinc sulfide and sulfur dioxide followed the equations ZnS plus 2SO2 yields ZnSO4 plus 2S and 2ZnS plus SO2 yields 2ZnO plus 3S. The reaction speed was slow, owing to formation of an alkaline sulfide densely coating the original sulfide. The reactions between FeS and SO2 and between FeS2 and SO2 follow the equations 3FeS plus 2SO2 yields Fe3O4 plus 5S and 4FeS2 plus 2SO2 yields Fe4O4 plus 8S. In

both cases, the reaction was completed within a short time. The reaction rate for FeS could be increased by addition of magnetic iron oxide which prevents the sintering that occurs when FeS is used alone. In the reaction with pyrite, the reaction was complete even with coarse pyrite.

6006 APTIC NUMBER 15025

Wood, O. R. and S. E. Schwarz
PASSIVE Q-SWITCHING OF A CO2 LASER. Appl. Phys. Letters, 11(8):88-89, Aug. 1, 1967. 5 refs.

Repetitive, passive Q-switching of a CO2-N2-He laser was obtained by using SF6 gas as the saturable absorber. The presence of the absorber results in a pulsed output with maximum intensity 200 times larger than that for continuous operation. Peak powers range from 80 W to 1 kW and pulse lengths from 0.4 to 2 microseconds. Both the vibrational relaxation time and the repetition time between pulses are 850 microseconds at 1 torr of SF6. The addition of larger amounts of helium to the absorber decreases the repetition time to 80 microseconds. Unlike continous operation, the Q-switch operation involves oscillation on only a single line of the rotation spectrum. Since their concentrations and lifetime can be readily changed, gases seem particularly well suited as saturable absorbers for infrared lasers.

6007 APTIC NUMBER 15886

Woods, F. J., M. P. Halstead, and J. E. Johnson
VAPOR-PHASE OXIDATION OF HYDROCARBONS. PART 2 - EFFECT OF OXYGEN CONCENTRATION ON PLATINUM-CATALYZED COMBUSTION AND IONIZATION. Naval Research Lab., Washington, D. C., Chemistry Div., Contract NRL Problem C 01-03, Proj. RR 001-06-41-5850, NRL Rept. 6916, 16p., Feb. 7, 1969. 13 refs.
AD 688072

The catalytic combustion of hydrocarbons was studied with particular attention given to the ionization phenomena associated with it. The greater ion yield of highly branched alkanes relative to straight chain alkanes was confirmed. The effect of the concentration of oxygen in the gas mixture on the extent of oxidation and ionization varied with the hydrocarbon used. In general, increase in O2 content caused considerable enhancement of the ion yield. However, with some hydrocarbons such as 2,2-dimethylpropane and 2,2-dimethylbutane, the fraction oxidized decreased markedly with increased O2 concentration in the temperature range, 600-700 C. The data seemed consistent with an explanation based on lower temperature oxidation occurring only on the platinum surface, whereas at higher temperatures the catalytic process extends itself to some degree into the vapor phase. It is also suggested that dissociative adsorption of O2 at higher temperatures is involved in the ion-producing process. (Author abstract modified)

6008 APTIC NUMBER 15911

Yamate, Noboru
PHOTOCHEMICAL STUDIES OF AIR POLLUTION. IV. STUDIES ON PHOTOCHEMICAL PRODUCTS OF AUTO EXHAUST. (Taiki osen no kokagaku kenkyu (dai 2 ho) Jidosha haiki gasu no koshosha seiseibutsu ni tsuite). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 15(4):248-252, 1969. 5 refs.

Automobile exhaust was irradiated with xenon or solar light under static conditions, and the concentration changes of hydrocarbons, nitrogen oxides, formaldehyde, and irradiation products were analyzed. Hydrocarbon concentrations were determined by hydrogen-flame ionization gas chromatography; nitrogen oxides and formaldehyde concentrations, by colorimetry; and irradiation products, by electron-capture gas chromatography. Irradiation decreased the concentrations of hydrocarbons and nitrogen oxides but increased formaldehyde concentrations. The irradiation products were methyl nitrite, ethyl nitrite, methyl nitrate, ethyl nitrate, n-propyl nitrate, isobutyl nitrate, biacetyl, and peroxyacetyl nitrate. These photochemical reactions of auto exhaust presumably occur in the atmosphere.

6009 APTIC NUMBER 15020

Yardley, James T. and C. Bradley Moore
LASER-EXCITED VIBRATIONAL FLUORESCENCE AND ENERGY TRANSFER IN METHANE. J. Chem. Phys., vol. 45:1066-1067, 1966. 10 refs.

The collisional relaxation time for the transfer of vibrational energy from the asymmetric stretch to the bend of methane were measured. Ultrasonic measurements indicate that most polyatomic molecules exchange vibrational energy rapidly among the excited states and lose energy to translation and rotation via the lowest-energy mode. Measurements confirmed this conclusion for methane and yielded stretch to bend rates for comparison to theory.

6010 APTIC NUMBER 14629

Yermolenko, Y[illegible] Ye. N. Yermolenko, and G. A. Popkovich
METHOD OF C[illegible]ATION IN THE PREPARATION OF ACTIVE ADSORBENTS [illegible]STS. (Metod soosazhdeniya v poluchenii aktivnykh a[illegible]y i katalizatorov). Text in Russian. Vestsi Akad. Navuk B[illegible] SSR: Ser. Fiz Navuk, no. 3:8-22, 1967. 42 refs.

Thermogravimetric measurement of coprecipitated SiO2-Mg(OH)2 and thermographic and x-ray studies of coprecipitated SiO2-Mg(OH)2, SiO2-Fe(OH)3, and SiO2-Cr(OH)3 are reported. Isotherms are given for carbon tetrachloride adsorption on Mg(OH)2 and on SiO2-Mg(OH)2 after calcination at various temperatures from 200 to 1100 C. The coprecipitates exhibit different properties from simple mechanical mixtures of their components. More intimate contact between components in the coprecipitates sometimes results in formation of the hydrosilicate of metal (e.g., Mg), sometimes in mutual protection against crystallization, or a shift of crystallization to higher temperatures (e.g., Cr). Adsorption properties of coprecipitated systems are thermally more stable and

adsorption deactivation is retarded. Coprecipitated chromium and nickel hydroxides in a ratio of 33:67 exhibit mutual protection from crystallization and this property increases as the ratio approaches 50:50.

6011 APTIC NUMBER 15695

Yoshida, Hiroshi and Yuji Moritawa
AN APPARATUS FOR BLOWING SOOT. (Suss buki sohchi). Text in Japanese. (Mitsubishi Heavy Industries, Ltd., Tokyo (Japan)) Japanese Pat. Sho 40-12322. 2p., June 4, 1969. (Appl. Aug. 20, 1966, claims not given).

The apparatus for blowing soot consists of a tube the length of a hearth which has a row of nozzles parallel to the axis; it is supported in a hole of a bearing board fixed to the hearth wall. The gas media, such as steam or compressed air from the nozzles, blows the soot by turning back and forth through the prescribed length of the hearth. When the nozzles blow toward the front of the hearth, the flow of the gas in the hearth is hindered, thus increasing the pressure in the hearth. If the pressure increase is too great, the hot gas is emitted from the opening. This tendency is more noticeable in smaller hearths, and disturbs the running condition by lowering the efficiency, thus creating a danger for the operator. This inefficiency is corrected by the present invention. Nozzles are arranged in a spiral form, and the tube rotates around the axis. Because the flow of the hot gas is not disturbed, and the effect on the gas flow is always constant, a pressure increase is prevented. Thus, the boiler runs steadily and easily with a high efficiency. To limit the blowing to a certain section, a cover is fixed on the bearing board for that part of the tube. The arrangement takes the use of a complicated apparatus to limit the motion of the tube unnecessary. The nozzles may be placed in several rows.

6012 APTIC NUMBER 15253

Young, R. A., G. Black, and T. G. Slanger
VACUUM-ULTRAVIOLET PHOTOLYSIS OF N2O. III. REACTION RATES OF O(1S). J. Chem. Phys., 50(1):309-311, Jan. 1, 1969. 13 refs. (Also: Stanford Research Inst., Menlo Park, Calif., Contracts DA-31-124-ARO-D-439 and DA-31-124-ARO-D-446 and Grant 548, Repts. 5134.11-P and 6093.11-C, 1969.)
AD 686936

Photolyses of N2O at 1470 A (Ye resonance lamp) and CO2 at 1048 + 1067 A (argon resonance lamp) were used as sources of O(1S) atoms. Quenching rate coefficients for this species relative to those for N2O or CO2 were determined for a wide variety of gases (NO, C2N2, O2, CO, H2, CH4, N2, Ar, He, ethylene, and acetylene).

6013 APTIC NUMBER 15272

Young, R. A., G. Black, and T. G. Slanger
VACUUM-ULTRAVIOLET PHOTOLYSIS OF N2O. IV. DEACTIVATION OF N2(A 3(SIGMA SUB U)+) AND N2(B 3(PI SUB G)). J. Chem. Phys., 50(1):303-308, Jan. 1, 1969. 27 refs. (Also: Stanford Research Inst., Menlo Park, Calif., Contracts DA-31-124-ARO-D-439 and DA-31-124-ARO-D-446 and Grant GI-548, Repts. 5134.10-P and 6093.10-C, 1969.)
AD: 687068

Quenching of N2(A 3(sigma sub u)+), produced during photodissociation of N2O by 1470 A radiation, was studied using the N2 gamma-band emission as a monitor. The relative quenching efficiencies of a variety of gases are given. At 1236 A, the state of N2(B 3(pi sub g)) was produced during photolysis of N2O and the variation of the intensity of N2 first positive emission with N2O pressure was used to evaluate the quenching rate of N2(B 3(pi sub g)) by N2O. The value obtained was 1.6 times 10 to the minus 10th cc/molecule/sec. Quenching efficiencies for other gases (NH3, NO, C2N2, O2, CO, CO2, H2, CH4, N2, Ar, He, ethylene, and acetylene) were determined relative to N2O and are given. (Author abstract modified)

6014 APTIC NUMBER 15667

Yurieva, T. M., G. K. Boreskov, and V. Sh. Gruver
THE MECHANISM OF CARBON MONOXIDE CONVERSION OVER COPPER CHROMITE AND CHROMIUM OXIDE IN THE PRESENCE OF WATER VAPOUR. (Mekhanizm reaktsii konversii okisi ugleroda s vodyanym parom na khromite medi i okisi khroma). Text in Russian. Kinetika i Kataliz, 10(4):862-868, 1969. 8 refs.

Experiments were carried out to verify a two-stage scheme involving transfer of oxygen, first to the catalyst and then from the catalyst to carbon monoxide over copper chromite and chromic oxide catalysts. Direct measurements were taken of the rates of the oxidation and reduction stages. In each case, the two-stage reaction was not confirmed. In the case of copper chromite, it is proposed that the reaction proceeds by means of an active complex containing both CO and H2O molecules, possibly through the reaction of two adsorbed molecules, i.e., according to the so-called Langmuir-Hinchelwood scheme. In the case of chromium oxide, the reaction apparently proceeds by means of an active complex comprising both of the reagents. The fact that chromium oxide, unlike copper chromite, does not adsorb significant quantities of carbon monoxide suggests that the reaction takes place between adsorbed water molecules and gaseous CO.

6015 APTIC NUMBER 18869

Zambonin, Pier Giorgio and Joseph Jordan
CHEMISTRY OF ELECTRON TRANSFER AND OXYGEN TRANSFER IN FUSED SALTS. J. Am. Chem. Soc., 89(24):6365-6366, Nov. 1967. 15 refs.

The prevalence of the oxygen-transfer and electron transfer processes is indicated by experimental results which were substantiated polarographically by Levich's rotated platinum disk electrode in solutions prepared by adding pure sodium oxide to a fused equimolar sodium-potassium nitrate solvent at 265 C. The steady state current-voltage curve exhibits several sigmoid waves reminiscent of the shape of classical polarograms. Four

well-defined limiting current domains are evident. Their dependence on the angular velocity of the rotated disk indicator electrode was found to obey Levich's applicable equations. This concordance indicated that experimentally observed limiting currents were controlled by the rate of transport of the electroreactive species from the bulk of the melt to the electrode surface under conditions of extreme concentration polarization.

6016 APTIC NUMBER 15085

Zeilinger, J. P.
PREPARATION CHARACTERISTICS OF COAL FROM CLAY, GILMER, AND LEWIS COUNTIES, W. VA. Bureau of Mines, Washington, D. C., RI 7216, 40p., Jan. 1969. 10 refs.
PB-183375

The preparation characteristics of coalbeds in Clay, Gilmer, and Lewis Counties, W. Va. are described. Because of stringent air pollution control regulations, considerable emphasis was placed on the sulfur content of the fuels. Coal samples were classified by sulfur content both as received and after removal of the sink 1.50 specific gravity material. Washability analyses were made of 16 coalbed samples. Each sample to be tested was air-dried and processed through the specific gravity solutions. The sample was placed in a specific gravity bath in small quantities to prevent entrapment, stirred, and allowed to settle. The floating coal was then removed with a screen-wire strainer. The sink portion, having settled into a container with a screen bottom in the bath, was raised above the liquid level and allowed to drain. Each fraction was analyzed for ash and sulfur content. The results showed that only 11 samples could be upgraded to metallurgical quality. For steam and power generation, five of the coals were of low sulfur content (1% less) as received. The remaining samples were generally of medium sulfur content (1.01-3%) even after upgrading.

6017 APTIC NUMBER 15021

Zernike, F. and C. Van Lier
THEORY OF THE SENFTLEBEN EFFECT. Physica, 6(9):961-971, Oct. 1939. 8 refs.

A quantitative explanation is developed for Corter's theory that paramagnetic gases in a magnetic field have slightly smaller heat conductivity and viscosity than in the absence of the field. Calculations are based on the mean free path theory and assume that the collision probability of a diatomic molecule depends on its cross section perpendicular to the direction of motion. Equations are derived to explain observed differences between longitudinal and transverse effects and the dependence of these effects on the magnetic field. Results of the analysis confirm that the Senftleben effect is caused by the precession that the magnetic field imparts to the molecules during their free motion between collisions.

6018 APTIC NUMBER 15093

Zhdanov, A. F. and V. V. Yakovlev
SOLUBILITY OF LEAD SULFATE IN ELECTROLYTE SOLUTIONS AT 25 C. (Rastvorimost' sul'fata svintsa v rastvorakh elektrolitov pri 25 ts). Text in Russian. Uzbeksk. Khim. Zh., no. 2:5-10, 1958. 3 refs.

Solubilities of lead sulfate at 25 C were determined for the following ternary systems: PbSO4-NaNO3-H2O; PbSO4-NaCl-H2O; PbSO4-NaBr-H2O; and PbSO4-NaC2H3O2-H2O. The sodium salt concentrations were varied from 0.001 to 3 moles/liter. Solubility of the sulfate increased with the concentration of additional salt in every case. Relative nitrate solubility with these salts increases in the following order: NaNO3, NaCl, NaBr, NaC2H3O2. Experimental data were used to calculate the products of lead sulfate activities in first and second approximation according to the Debye-Huckel equation.

6019 APTIC NUMBER 15081

Zimin, F. D. and V. A. Popov
EXPERIMENTAL INVESTIGATION OF ELECTRICAL CONDUCTIVITY OF PRODUCTS OF COMBUSTION, STIMULATED BY SOLID PARTICLES. Eksperimental'noye issledovaniye elektroprovodnosti produktov sgoraniya, stimulirovannoy tsvetymi chastitsami). Source not given. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 17p., Aug. 23, 1968. 7 refs. FTD-MT-24-183-68
CFSTI: AD 685511

An experimental study was carried out on the electrical conductivity of the products of combustion of methane with oxygen-enriched air in the presence of solid particles of various substances. By artificially introducing solid particles, the electrophysical properties of the working gas was improved. Solid particles transported from the combustion chamber may be present in the duct of an open-cycle MHD generator working with products of coal combustion. In addition, when there are sufficiently large temperature reductions in the rear part of the duct, particles may form through the condensation of combustion product volatile directly into the solid phase. Experiments showed that the introduction of particles stimulates the electrical conductivity of the products of methane combustion which, without particles, are nonconducting. The dependence of temperature, particle size, and the relative mass flow rate was studied. A sharp increase in electrical conductivity was noted in the range of 1800-2100 K. The ash content spectrum of particles from natural fuels was investigated. The maximum conductivity was obtained with the introduction of ash particles, while the smallest value corresponded to carbon particles. However, particles of low-ash coals were only slightly inferior from the viewpoint of stimulating conductivity. The dependence of conductivity on ash content was 18%. With a further increase in ash content, the electrical conductivity drops, and for an ash content of 50% a minimum was observed, after which the conductivity increases to a maximum value corresponding to ash. The maximum ash content at 18% is explained by the release of volatile components from the coal. This conclusion is supported by measurements made on coke particles. The electrical

conductivity obtained was close to that for pure carbon and differed greatly from that relating to coal.

6021 APTIC NUMBER 14709

Zimmermann, F. K.
GENETIC EFFECTS OF POLYNUCLEAR HYDROCARBONS: INDUCTION OF MITOTIC GENE CONVERSION. Z. Krebsforsch., 72(1):65-71, 1969. 28 refs.

Mitotic gene conversion is a process which causes genetic variegation in somatic cells by the interaction of two different alleles of the same gene due to a presumably localized pairing of homologous chromosomes. Five polynuclear hydrocarbons were tested for their ability to induce mitotic gene conversion in a deploid strain of Saccharomyces cerevisiae. To enhance the sensitivity of the test system, the yeast was also made respiratory-deficient. Such a strain, in the absence of a fermentable substrate, was deprived of energy sources and consequently, unable to repair DNA damage. Under these conditions, mitotic gene conversion was induced by 9, 10-dimethylbenzanthracene, but not by pyrene, 1, 6-benzpyrene, 1, 2-benzanthracene, or 1, 2, 5, 6-dibenzanthracene. The inactivity of the latter compounds was ascribed either to their inability to react directly with DNA, or to the lack of activating enzymes in the yeast cells. The results are discussed in the light of a general genetic theory of carcinogenesis including karyotic genetic effects such as mutation, mitotic recombination, and mitotic gene conversion, as well as cytoplasmic mutation. (Author summary modified)

6021 APTIC NUMBER 12755

Zimmermann, F. J. and D. C. Diddams
THE ZIMMERMANN PROCESS AND ITS APPLICATIONS IN THE PULP AND PAPER INDUSTRY. Tappi, 43(8):710-715, Aug. 1960. 9 refs.

The Zimmermann process is a patented wet-air oxidation system (U. S. Pat. 2,665,249) which has applications for both paper-mill waste disposal and the recovery of chemicals. Wet oxidation of a variety of spent pulping liquors has been carried out in stainless steel reactors at temperatures from 200 to 300 C and 400 to 3000 psi. The oxidation of combustibles has been as high as 95% complete. The process is a continuous operation under pressure which oxidizes combustible matter with air while both are dissolved or suspended in water. The combustion is achieved as well in water at elevated temperature and pressure as by evaporating the water and incinerating the dried residue. The products in either case are steam, nitrogen, carbon dioxide, and ash. In wet combustion the reaction occurs, and the energy is liberated in the water phase with no barrier to the transfer. The energy contained in the oxidation effluent vapor, gas, and liquid phase can be utilized in a number of ways. Using it as steam and electricity is illustrated. Oxidation data on pulping wastes suggest that stream pollution can be reduced over 90%. Power and chemical recovery can be designed to fit the specific requirements of kraft, sulfite, and semichemical pulping processes.

6022 APTIC NUMBER 15918

Zimon, A. D. and E. A. Lazarev
ADHESION OF PARTICLES FROM AN AIR STREAM ON AN OBSTACLE: DEPENDENCE OF PARTICLE ADHESION ON THE VELOCITY OF AIR STREAM. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 31(1):47-49, Jan.-Feb. 1969. 4 refs.

The distribution of spherical glass particles less than 30 micron in diameter on plates was investigated as a function of air stream velocity from 1 to 5 m/sec. When the results were plotted as the number of adhering particles vs velocity, a curve was obtained that crosses three regions. The number of adhering particles decreases with an increase in particle velocity from 1 to 5 m/sec and increases at velocities above 100 m/sec. The type of dependence of the number of adhering particles changes twice: in the transition from region one to region two, and from region two to region three of the curve where the number of adhering particles is independent of velocity. The maximum diameter of particles deposited on the plate decreases with increased stream velocity. It is 7 micron at 150 m/sec, 5 micron at 300 m/sec, and 2.5 micron at 500 m/sec. The median particle diameter increases with the angle of attack of 150 m/sec velocity. At an angle of 0 deg, the median diameter is 1.7 micron; at 30 deg, 2.0 micron; and at 90 deg, 2.6 micron. Velocity distribution in a laminar boundary layer conforms to a linear law, and the aerodynamic force is greater for large particles and less for relatively small particles. In turbulent flow, a thin laminary sublayer with linear variation of velocity is present near the surface of the body. At zero angle of attack on particles submerged in the laminary sublayer, the aerodynamic force diminishes. The aerodynamic force increases when particles are thicker than the sublaminar layer. A semiempirical formula is derived for calculating the thickness of the laminary sublayer and determining the maximum diameter of particles adhering to a gas stream. Calculated values are in good agreement with experimental data.

6023 APTIC NUMBER 18803

Zimon, A. D.
FORMATION OF PARTICLE ADHESION. Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 29(6):660-662, Nov.-Dec. 1967. 5 refs.

Adhesion is determined by the adhesive force arising during contact of particles with various surfaces. In view of the fact that a distribution of particles by adhesion force is obtained, the concept of the adhesion number is introduced. The adhesion number is the ratio of the number of particles remaining after the action of a certain force on the adhering particles to the number of particles initially present on the surface. Thus, particle adhesion is measured by the adhesive force and the adhesion number. For correct evaluation of experimental data it is necessary to determine the accuracy of the methods used for measurement of adhesive forces and to demonstrate the relative nature of the adhesion numbers. It is concluded that the determination of adhesion from adhesion numbers under the

influence of the same detachment force, or from equal adhesion numbers with different detachment forces, is incomplete and gives only a relative characterization of the interaction of the particles with the surface. Particle distribution by adhesive forces is the logarithmic-normal type as determined for adhesion of glass particles and of starch particles. The average adhesive force of all the particles, which is the most complete measure of adhesion, is determined from the particle distribution by adhesive forces.

6024 APTIC NUMBER 15062

Zolotarev, V. S., A. V. Vlasov, and V. G. Komar
ISOTOPE SEPARATION BY ELECTROMAGNETIC SEPARATORS IN THE SOVIET UNION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 3:471-479. 6 refs. (Translated from Russian.)

Electromagnetic separation of isotopes in the Soviet Union is reviewed. At present, there are more than 12 large electromagnetic separators of various types in use; their principal characteristics are given with reference to types of magnetic fields, magnet vacuum tanks, vacuum units, and electrical equipment. After extensive testing of many types of ion sources, a powerful large-scale source with a magnetic field arc discharge was chosen. Ionization in the source is produced by a beam of electrons emitted by an indirectly-heated cathode and concentrated by the magnetic field; thus the ionization zone is brought closer to the arc slit in order to receive a narrow intense ion beam. Ion sources in present use are described according to the temperature ranges of the material being vaporized: up to 400-600 C, mainly for solid charge and for liquids and gases; temperatures to 1500 C, the sources for which involve a vapor-generating system; and high-temperature sources up to 2800 C, used mainly for the platinum-palladium group. The various types of receivers used for collecting separated ions are also described. Chemical processes are required for preparing charge material and for treating separated isotopes extracted from receiver pockets. A flow chart of the electromagnetic separation process is given, and the basic criteria of the process - output, charge material utilization efficiency, and enrichment are discussed. Enrichment on Soviet separators is judged to be generally about the same as on separators operated in the U. S. and England. In large-scale electromagnetic separation, the enrichment factor per cycle is 20 to 40, but under especially favorable conditions may reach much higher. In most cases, a sufficiently enriched product can be obtained in one cycle. At present, electromagnetically separated isotopes are used primarily in basic research in nuclear and atomic physics, with some applications in other sciences.

6025 APTIC NUMBER 15065

Zuk, W., D. Raczka, and J. Pomorski
ELECTROMAGNETIC ISOTOPE SEPARATOR AT LUBLIN. Nucl. Instr. Methods, 37(2):249-258, Dec. 1965. 18 refs.

A laboratory-type isotope separator is described. The separator has a 90 deg magnetic lens with the symmetrical image of an object. The ion beam radius in the magnetic field is equal to 150 cm, insuring heavy elements dispersion of the order of 8 mm per mass unit and a resolving power above 1000. Special attention was concentrated on the construction of the electromagnetic coils, the ion source coil, and coil cooling systems. The arrangement of the ion accelerating lens the optics system and construction of the high temperature sources are discussed. The arrangement of the electronic systems, the high voltage for accelerating the ion beam, the electromagnetic current stabilizer, and the ion beam position stabilizer are also described. Separator efficiency depends on the elements and chemical compounds used for separation. Gas elements, as well as low pressure element isotopes, can be separated after first bringing them into the vapor state. Based on one year's experience, good results are obtained in separating noble gas isotopes, solid elements such as Pb, Tl, W, Ni, and Cu, and some rare earth elements.

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6026 APTIC NUMBER 15080

Agate, John N., G. H. Bell, G. P. Boddie, P. G. Bowler, Monamy Buckell, P. A. Cheeseman, T. H. J. Douglas, W. A. Druett, Jessie Garrad, Donald Hunter, K. M. B. Perry, J. M. Richardson, and I. P. de V. Weir
INDUSTRIAL FLUOROSIS: A STUDY OF THE HAZARD TO MAN AND ANIMALS NEAR FORT WILLIAM, SCOTLAND. Med. Res. Council Memo. 22(1949), 111p. 192 refs.

The effects on health of fluorine escaping from an aluminum factory were studied. Fluorine concentrations in the factory room were as high as 3.60 mg/cu m and outside the factory varied from 1-15% of the average factory room concentration, depending on the distance from the factory. It was established that chronic endemic dental fluorosis affecting both cattle and sheep occurs in the area near the aluminum factory. A substantial measure of osteodystrophia occurs in cattle grazing in this vicinity, and dental lesions are confined to animals reared on contaminated pastures. Cases of osteomalacia due to chronic fluorine intoxication was also found. Loss of milk in affected animals was severe. Volunteers from factory workers and from adults and schoolchildren living in the neighborhood were examined. The factory workers were divided into two groups; those working in the furnace room and those from other departments. The examinations covered full occupational and medical histories, complete physical examination, X-rays, and for selected individuals, a full blood count and an estimation of blood fluorine and urinary fluorine concentrations. The excretion of fluorine in the furnace-room workers ran parallel to the intensity of exposure. Some of the older workers, exposed for a number of years, showed bone changes recognized as fluorosis. Despite the bone changes, none of the workers were found to suffer clinical disability. Some degree of mottling was found in the teeth of schoolchildren, but mottling was also found in schoolchildren in an area which was far removed from the aluminum factory. Clinical examination of a number of resident in the neighborhood of the factory showed no injury to health. It was concluded that while direct exposure to fluorine does not impair the health of man and animals, fluorine emissions from the factory should be reduced. (Author summary modified)

6027 APTIC NUMBER 15245

Abodov, T. M. and B. V. Ostroumov
ALLERGY TO COMMON RAGWEED (AMBROSIA ARTEMISIAEFOLIA). (Allergiya k polltse ambrozii polynnolistnoy). Text in Russian. Sov. Med., vol. 29:96-99, Dec. 1966. 8 refs.

The sensitivity of 258 allergy patients to common ragweed was studied. Cutaneous testing revealed elevated sensitivity in 78% cases; these patients had histories of annual affection from late July to late September (during ragweed blossoming). During this period, the common ragweed pollen count reaches as high as 100 and more per cu cm. Repeated subcutaneous injection of common ragweed extract has proven to be a very effective therapy.

6028 APTIC NUMBER 15758

Ashley, David J. B.
ENVIRONMENTAL FACTORS IN THE AETIOLOGY OF LUNG CANCER AND BRONCHITIS. Brit. J. Prevent. Social Med. (London), 23(4):258-262, Nov. 1969. 28 refs.

A multiple regression analysis of the relationship between mortality from lung cancer and bronchitis and a series of environmental factors was conducted. There was a significant positive association with increasing population density and lower social class in lung cancer in men and women and in bronchitis in men. There was a negative association between the concentrations of the coal and textile industries and mortality in all three groups. This association was significant in lung cancer in men. There was a significant positive association between air pollution, in particular the smoke concentration in the atmosphere, and the death rate from bronchitis in males. There was a significant negative association between the concentration of sulfur dioxide in the atmosphere and the mortality of men from lung cancer. It was suggested that the effect of the coal and textile industries in reducing lung cancer mortality may be related to an enhanced state of immunological preparedness in the lungs of people constantly exposed to dust. A similar mechanism may operate with sulfur dioxide, or, alternatively, there may be a more specific effect on the reaction between sulfur-containing amino acids in the inspired air. (Author summary modified)

6029 APTIC NUMBER 15906

Ashley, David J. B.
ENVIRONMENTAL FACTORS IN THE AETIOLOGY OF GASTRIC CANCER. Brit. J. Prevent. Social Med. (London), 23(3):187-189, 1969. 18 refs.

The relationship between mortality from gastric cancer in men and women and a number of environmental factors was analyzed using the method of multiple regression. A positive correlation was found for general social factors, population density, and social class. A correlation for men was also found for atmospheric pollution. Dusty coal and textile industries were also associated with the occurrence of gastric cancer. It was suggested that the cause of gastric cancer may be the inhalation of carcinogenic substances from atmospheric pollutants, dusty coal and textile industries, followed by the swallowing of sputum. An alternative suggestion was that food may be contaminated before ingestion by carcinogens in the atmosphere or dust. (Author summary modified)

6030 APTIC NUMBER 18893

Ayres, Stephen M.
THE EFFECTS OF AIR POLLUTION UPON HEALTH. Proc. Rutgers Seminar on Legal Aspects of Air Pollution, New Brunswick, N. J., 1967, p. 17-27, May 6, 1967. 12 refs.

Scientific evidence which indicates that present levels of air pollution may seriously impair health is presented. Chronic lung diseases which may either be caused or aggravated by exposure to the polluted air include bronchial asthma, chronic bronchitis, and chronic obstructive emphysema. Pathologic studies of human lungs showed that while the lungs of country dwellers are pink, the lungs of city dwellers are black which is due to the accumulation of carbon particles after prolonged exposure to polluted air. Epidemiologic studies demonstrated that both acute exposure to high concentrations, and chronic exposure to low concentrations, of pollutants may produce lung problems. The frequency with which patients attend a hospital emergency room complaining of respiratory difficulty was correlated with daily concentrations of sulfur dioxide and particulate material. A consistent correlation was observed with both pollutants, but the best relationship was noted between respiratory illness and particulate concentration three days earlier, suggesting a time lag before the development of pulmonary symptomatology. In certain areas, the incidence of respiratory disease is so great that the appearance of a new variety of illness is suspected. In exposure studies, humans with normal lungs or with either bronchitis, asthma, or emphysema were exposed to irritant pollutants. The variation in response was great in all groups, but the asthmatics demonstrated the greatest amount of bronchoconstriction when exposed to sulfur dioxide. This variability explains why certain individuals become ill during a thermal inversion, while others remain asymptomatic. The effects of carboxyhemoglobin on the heart were also studied. As little as 5% carboxyhemoglobin interfered with oxygen delivery to the heart muscle, and produced serious effects in patients with coronary artery disease. According to observations, small amounts of carbon monoxide seriously interfere with mental function.

6031 APTIC NUMBER 14597

Bakalinskaya, F. D.
THE EFFECT ON EXPERIMENTAL ANIMALS OF THE DUST OF A MIXTURE OF MG-MN AND MN-ZN FERRITES. (Nekotorye dannye o vliyanii na organizm eksperimental'nykh zhivotnykh pyli shikhty magnii-margantsevykh i margantsevo-tsinkovykh ferritov), Hyg. Sanit., 33(4-6):424-426, April-June 1968. 2 refs.

Ferrites are ceramets containing ferric oxide as a major component, the most common of which are Mg-Mn, Mn-Zn, Ni-Zn, and barium. Compound ferrites have been reported to exert fibrotic and toxic effects. The effects of a mixture of Mg-Mn and Mn-Zn ferrites with a high content of toxic components -- the oxides of Mg(23%), Mn(19%), Zn(5%), Ca(5%), and Fe(43%) were studied. Albino rats were exposed to the dust intratracheally and by inhalation. The criteria of toxic effects were the live weight changes, as well as weight of the lung on autopsy and the presence of pathomorphological changes in the internal organs. An analysis of the findings showed that ferric oxide dust caused mild inflammatory and sclerotic changes in the lungs, whereas Mg-Mn and Mn-Zn ferrite dusts, in addition to more marked local fibrotic effects, also produced a general effect, indicated by a weight lag in the test animals and the development of dystrophic changes in the internal organs. These findings confirm the fact, that the pathological process is induced by the ferrites investigated is controlled by the most toxic components: Fe, Mg, and Zn. The permissible standards for the dust of Mg-Mn and Mn-Zn ferrites should therefore be fixed with regard to their content of these components.

6042 APTIC NUMBER 14791

Beckman, David L. and Harold S. Weiss
HYPEROXIA COMPARED TO SURFACTANT WASHOUT ON PULMONARY COMPLIANCE IN RATS. J. Appl. Physiol., 25(6):700-709, June 1968. 56 refs.

It is widely accepted that lung damage is a major toxic effect of 100% O2 at 1 ata (OAP). It is not clear, however, whether OAP attacks lung structural elements or the surface tension-lowering material at the air interface of the alveoli (surfactant), or both. The authors felt that further information on the nature of the action of OAP on the lung could be obtained from a study on highly susceptible adult rats sacrificed before asphyxic death; by direct evaluation of pulmonary tissue forces and surface tension via compliance measurements derived from air and saline pressure-volume curves; and by correlating compliance changes with surfactant extracted from the same lung by perfusion-transudation techniques. Air and saline pressure-volume curves were run on lungs from 220-g rats after 60 to 66 hrs in 1 ata oxygen. Inflation and deflation were continuous, with air at 20 sec/cycle to 20 cm H20, and with saline at 0.8 ml/min to the air volume. Total lung compliance was determined from the change in volume of the air curves between 5-15 cm H20, and tissue compliance from the slopes of the saline curves. An equation was proposed for compliance due to surface forces. Lecithin in the lung transudate obtained by saline perfusion was used as an index of surfactant. Surfactant washout in controls decreased total lung compliance and surface forces, but increased tissue compliance. Lecithin was highly correlated with either total lung compliance or surface forces. Oxygen thus lowered total lung compliance both by decreasing surfactant and by increasing tissue rigidity.

6043 APTIC NUMBER 15747

Belanger, William F.
A STUDY OF THE EFFECTS OF AIR POLLUTION ON HOSPITAL ADMISSIONS. Preprint, Philadelphia Dept. of Public Health, Pa., Air Management Services Div., 8p., Sept. 1969. (Presented at Air Pollution Committee Meeting, Philadelphia County Medical Society, Philadelphia, Oct. 27, 1969.)

A preliminary study on the effects of air pollution on health was conducted. Total oxidants, soiling index, sulfur dioxide, and nitrogen oxides were measured near the hospital. Hospital data were drawn directly from the patient-card files. Hospital admissions, after elimination of admissions not directly concerned with pollution effects, were broken into total respiratory admissions, respiratory infections only, respiratory infections including undiagnosed cases, respiratory growths, total respiratory for children under 10, total respiratory for adults over 60, eye irritation, cardiac patients, and vascular patients. Sixty-three

visual comparisons yielded one very strong correspondence between soiling index and total respiratory admissions. An additional relationship between sulfur dioxide and total respiratory admissions was weak. The breakdown of respiratory admissions into subcategories yielded numbers of admissions too low to make a comparison, and so the prediction of the sensitive areas of the population was not possible. Coefficients of correlation were calculated for individual months for total respiratory admissions against air pollution variables. Data showed significant correlations for soiling index, sulfur dioxide, and nitrogen oxides. The correspondence between soiling index and respiratory admissions was especially marked. This effect occurred as low as 0.75 COH. It was apparent that the correspondence of soiling index peaks and peaks in respiratory admissions should be further investigated. It was recommended that the soiling index be related to air quality standards with a maximum of about 0.75 COH.

6034 APTIC NUMBER 10759

Biersteker, K., H. A. van Geuns, and P. van Leeuwen
COUGH AND PEAK FLOW RATES OF MUNICIPAL EMPLOYEES IN ROTTERDAM.
Environ. Res., 2(4):272-276, 1969. 6 refs.

Approximately 25% of the older male municipal employees in Rotterdam examined had at least minor symptoms of chronic bronchitis. A case control study was done on 1218 employees to see whether micro- or macropollution played a part in the etiology of the disease. Each man with bronchitis symptoms was compared with a man of the same age group without a cough. The number of heavy smokers was significantly higher in the bronchitis group. To roughly quantitate chronic exposure to air pollution, the total years of residence in Rotterdam were compared among employees with and without bronchitis symptoms. There was no significant difference between the two groups. The data suggested that smoking (micropollution) played a greater role in the etiology of the disease than did the ambient air (macropollution). The peak flow rates (the highest result of at least three efforts in the sitting position) were used for a regression analysis to find the best equation. There was a decrease of the flow rates with age and the presence of bronchitis symptoms.

6035 APTIC NUMBER 15617

Bohlig, H.
OCCUPATIONAL AND ENVIRONMENTAL DANGER THROUGH ASBESTOS.
(Berufs- und Umgebungsgefaehrdung durch Asbest). Text in German.
Deut. Med. Wochschr., 93(32):1529-1531, Aug. 9, 1968. 9 refs.
(Includes comments by W. Hess, Deut. Med. Wochschr., 94(23):1253-1258, June 6, 1969.)

Asbestosis is not readily detected with X-rays in its initial stages, although normal functions may already be considerably reduced. As the disease progresses, the lungs restrict, and blood circulation and gas exchange in the lungs begin to malfunction. The disease is frequently accompanied by chronic bronchitis. Unlike silicosis, asbestosis does not stop when all exposure has ceased. The tuberculosis morbidity of persons with asbestosis is equal to those who have never been exposed to asbestos. It is lower than with silicosis patients. (This point was attacked by W. Hess who thinks that asbestosis does seem to enhance tuberculosis. In an answer to this attack, Bohlig claims that the high correlation of asbestosis with tuberculosis in this area is not yet clarified.) Mortality of asbestosis patients is high, and there is hardly any cure. The best help is prevention. And indeed, something has been accomplished in this respect in West Germany. In 1965, 4000 new silicosis cases were listed as compared with only 67 asbestosis cases. Dust elimination reduced the disease, and asbestosis patients can attain old age. Since 1957, a much worse consequence of asbesto dust inhalation has made its appearance, namely lung cancer. Unfortunately it is frequently accompied by maligmant mesothelioma of the pleura and peritoneum. Asbestos has become ubiquitous: it is found in brake linings, road pavements, as insulating material, in textiles, synthetics, cardboard paper, and so on. Asbestosis is no longer limited to occupational contact with the material.

6036 APTIC NUMBER 15233

Buroma, L., K. Biersteker, and H. de Graaf
AIR POLLUTION AND PUBLIC HEALTH IN ROTTERDAM. RESULTS OF AN INVESTIGATION ON THE ACUTE EFFECTS OF AN EXCEPTIONAL AIR POLLUTION INCREASE ON PUBLIC HEALTH. (Luchtverontreiniging en volksgezondheid in Rotterdam. Resultaten van een onderzoek naar de acute effecten van bijzondere luchtverontreinigingstoename op de volksgezondheid). Commission on Earth, Water and Air, Rotterdam, 54p., 1968. 35 refs. Translated from Dutch. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 54p., Sept. 29, 1969.

An investigation was made of possible direct effects of three air pollution peaks on human health in Rotterdam. For this purpose, daily mortality and morbidity data were collected for December 1952, January and February 1959, March 1961, and December 1962. High air pollution concentrations compared with average winter levels existed on January 29, 1959, March 8, 1962. Results show small increases in general mortality and hospital admissions of persons over 50 years of age for cardiovascular and respiratory diseases each time. The increases in mortality were greatest among persons over 60 years of age and in the diagnostic groups of tumors and cardiovascular diseases. For 1962, a more detailed search was made for data that might support the assumption of a casual relationship with air pollution. It was found that a control population, exposed to the same weather but less air pollution, showed a much less marked effect on mortality and sick leave absenteeism. In 1952, Rotterdam was covered by dense fog from December 5-9. Though London experienced a severe effect that time, there was no clear effect in Rotterdam. No air pollution measurements were made in 1952, but it is common knowledge that the emission of pollutants, especially of SO2, was much lower 10 years ago. The findings seem to indicate that Rotterdam has reached a level of industrialization and urbanization at which air pollution effects on human health begin to manifest themselves during abnormal weather once or more every 3 years. (Author summary modified)

6037 APTIC NUMBER 15675

Carrow, Lorraine
PULMONARY DISEASE AND AIR POLLUTION. Chicago Medicine, 71(15):581-586, July 20, 1968. 31 refs.

Over the past two decades the death rate for pulmonary emphysema, with or without bronchitis, has increased faster than for any other leading cause of death. Paralleling the increase in this disease has been the progressive rise in urban air pollution levels. Epidemiologic studies of morbidity and mortality suggest that there is a close relationship between both chronic bronchopulmonary disease and bronchogenic carcinomas and air pollution. While smoking appears to be the major factor in lung cancer, it does not account for the difference in incidence between urban and rural dwellers: presumably, there is a time dose relationship between incidence and both number of cigarettes and duration and levels of urban exposure. In acute catastrophic air pollution episodes, persons with chronic bronchopulmonary disease, asthma, and heart disease are the first to die. Fatal pollution levels in the London episode in 1962 were above 0.8 ppm SO2 and 1000 micrograms cu m of smoke. Average sulfur dioxide concentrations during the five days of the episode were 1.3 ppm. A similar concentration, 1.4 ppm, was recorded in Chicago in April 1966. At lower than catastrophic levels the incidence of acute and chronic respiratory illness is greatest among persons living in highly polluted areas. In treating patients with chronic pulmonary disease, doctors must consider aggravating pollutants in industrially contaminated environments.

6038 APTIC NUMBER 14893

Chen, C., K. Okamoto, and T. Nakajima
THE HISTOPATHOLOGICAL STUDY ON THE LUNG OF MICE EXPOSED TO 0.7-0.8 PPM NO2 GAS FOR A MONTH. (NO2 gas (0.7-0.8 ppm) ni rensoku ittagetsukan bakuro shita mausu hai no byori soshiki gaku teki kenkyu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(3):91, April 1969.

To study the effect of exposure to nitrogen dioxide gas on lungs and trachea, mice four weeks of age were placed in a exposure chamber and continuously exposed for 30 days to 0.7 to 0.8 ppm concentrations of nitrogen dioxide gas, supplied by heating liquid NO2. Air for dilution was passed through a dehumidifier, filter, and activated carbon. Air velocity in the chamber was 5 cm/sec, temperature 24 to 26 deg, relative humidity 40 to 70%, and the light transmission rate of dust was less than 1%. The mice were given ample food and water. A control group of mice was raised under similar conditions but in the absence of NO2. No statistically significant difference in growth rate was observed between groups. On the 15th day of exposure to the gas, accelerated secretion of mucus, degeneration, and desquamation were observed at the mucus epithelium of the trachea. Lung congestion and increased secretion of mucus in bronchial tubes was also noted. By the 30th day, advanced necative and degeneration of the mucus epithelium was evident in both lungs and trachea. The results show that catarrhal changes in lung and trachea occur following exposure to less than 1% (sic; 1 ppm/) NO2 gas.

6039 APTIC NUMBER 14982

Chung, Kyou Chull, Seung Han Lee, and Kwang Mook Lee
EPIDEMIOLOGICAL STUDY ON AIR POLLUTION AND ITS EFFECTS ON HEALTH OF URBAN POPULATION. (De ki oh yum se see min bo kun e michinun youngkyang e kwanha chosa yun kool). Text in Korean. 1969. 53 refs.

Hourly and daily changes in CO, SO2, and smoke concentrations were determined for various parts of Seoul. Traffic density, road conditions, and the connection between meteorological conditions and density of houses were investigated. Estimations of daily and monthly ambulance rates for patients with respiratory diseases, and carboxyhemoglobin studies provided a measure of the effect of air pollution on the health of an urban population. Approximate daytime concentrations of SO2 were 0.38-0.48 ppm along the streets of central Seoul, 0.27-0.38 ppm in industrial zones, and 0.19-0.21 ppm in residential areas. Approximate daytime concentrations of CO were 34.7-38.7 ppm along the streets of the central district, 12.1-19.8 in industrial zones, and 9.8-15.9 in residential areas. Air pollution was greatest from 9 am to 6 pm, when the atmosphere was settled and the traffic heavy. The density of air pollution coincided with periods of lessening visibility and had a close connection with wind velocity. The daily ambulance rate of respiratory patients had a close connection with ambient air concentrations of SO2 and CO. For men, the order of carboxyhemoglobin saturation was office workers, traffic policemen, students, the unemployed, merchants, and industrial workers; for women, the order was housewives, office workers, saleswomen, and industrial workers. The results indicate that the degree of air pollution in Seoul far exceeds maximal permissible concentrations and that the briquets used for cooking and for heating homes are as hazardous to health as industrial and automotive emissions.

6040 APTIC NUMBER 14827

Coburn, R. F., W. Swerdlow, K. J. Juomanmaki, R. E. Forster, and E. Powell
DIFFUSE OF CARBON MONOXIDE FROM THE URINARY BLADDER OF THE DOG. Am. J. Physiol., 215(5):1010-1023, Nov. 1968. 36 refs.

Measurements were made of rates of uptake of CO from the lumen of the gas-filled canine urinary bladder as a function of lumen CO tension, O2 tension, and lumen volume. The uptake of CO is limited by diffusion at lumen CO tensions of 3 to 450 mm Hg and by rates of blood flow in gas-exchange vessels at higher lumen P(CO). Gas exchange occurs in a superficial vascular bed that is physiologically separated from deeper vessels. Calculations of rates of mucosal blood flow, the diffusing capacity of the bladder, and volume and transit times of gas-exchange vessels were made from CO uptake data. Equations were derived which describe the variables that influence CO uptake into a model capillary and allow calculation of changes in capillary P(O2) during CO uptake. Rates of N2O and C2H2 uptake were greater than could be explained by absorption

into the vessels involved in CO uptake. Evidence is presented that a significant fraction of the total uptake of these inert gases is unrelated to blood flow. (Author abstract modified)

6041 APTIC NUMBER 15458

Corn, Morton
PROPERTIES OF URBAN AEROSOLS AND THEIR POSSIBLE RELATIONSHIPS TO PULMONARY RESPONSE. Preprint, American Chemical Society, Washington, D. C., 21p., 1968. 32 refs. (Presented before the American Chemical Society, Div. Colloid and Surface Chemistry, 156th National Meeting, Atlantic City, N. J., Sept. 8-13, 1968.)

Properties of dispersed urban particulates which are required to describe their potential for evoking responses in man are aerodynamic particle size distribution, specific surface, concentration, and chemical composition with respect to size. Recent information, including the mechanisms by which responses are evoked, on these properties for the Pittsburgh urban aerosol is summarized. The nature of immediate or long-term pulmonary response is determined by the deposition sites in the respiratory tract and the chemical composition of the particles. The biological transport and clearance processes of particles following deposition will vary with the site of deposition and the physical and chemical properties of the particles. Changes in reflex airway constriction and peripheral respiratory unit contraction are associated with changes in airway resistance and lung compliance. Reflex bronchoconstriction is characterized by increased frequency of discharge of vagal efferent fibers to bronchi, bronchoconstriction which can be prevented by vagotomy or atropine, increased pulmonary flow resistance, decreased anatomic dead space or tracheal volume, but no significant changes in lung compliance. These changes are caused by constriction, but not actual closure of the large conducting airways supplied by vagal efferent fibers. Constriction of airways after introduction into or release from the pulmonary circulation of substances capable of constricting airway smooth muscle is characterized by increased pulmonary flow resistance, decreased lung compliance, increased anatomic dead space, increased end-expiratory transpulmonary pressure, and decreased functional residual capacity. These changes are explained by constriction of terminal respiratory units perfused by the pulmonary circulation without significant narrowing of the large airways. It is assumed that alterations in airway resistance are a sensitive indicator of urban pollutant concentrations. To collect pertinent data on particle parameters likely to produce pulmonary responses, the use of graded filters with known particle collection efficiencies for each stage is advocated.

6042 APTIC NUMBER 15703

Delwaide, P., C. Heuschen, and A. Noirfalise
CHRONIC LEAD POISONING: BIOCHEMICAL LESIONS AND BIOCHEMICAL SYMPTOMATOLOGY. (Le saturnisme: Lesions biochimiques et semeiologie biologique.) Translated from French. Ann. Biol. Clin. (Paris), 26(7-9):987-1001, 1968. 88 refs.

This paper reviews what is known about lead metabolism, and discusses biochemical toxicology, the biosynthesis of porphyrins, iron metabolism, the effect of lead on mature erythrocytes, and other metabolic disturbances. The complexity of lead metabolism precludes any diagnostic value of isolated lead level determinations in blood or urine. To demonstrate the state of impregnation of the organism with this toxin, the test of provoked urinary lead excretion should be performed in the chronic stage. Furthermore, a battery of assays including the levels of delta-ALA, PBG, CP and free PP in erythrocytes are required to reveal the biochemical disturbances at the target level where individual variations may play a role.

6043 APTIC NUMBER 18760

Densen, Paul M., Ellen W. Jones, Hyman E. Bass, Joseph Breuer, and Elizabeth Reed
A SURVEY OF RESPIRATORY DISEASE AMONG NEW YORK CITY POSTAL AND TRANSIT WORKERS. 2. VENTILATORY FUNCTION TEST RESULTS. Environ. Res., 2(4):277-296, 1969. 8 refs.

One-second forced expiratory volumes (FEV) were measured for 12,500 men in New York City in a survey of respiratory symptoms among postmen and transit workers. The study design and data on prevalence of symptoms were given in an earlier report. Study of ventilatory function test results showed distinctive patterns with respect to age, smoking habits, and respiratory disease symptoms. One-second forced expiratory volumes decreased with age in all study groups. Age-specific means were slightly higher for white than for non-white men. The lowest FEV values were found among cigarette smokers, especially the heavy smokers, and the highest values were those of non-smokers or men without symptoms. Variations in patterns of the decline with age, as well as differences in age-specific mean FEV values, were evident among groups of men reporting different symptoms of respiratory disease. (Author abstract modified)

6044 APTIC NUMBER 15315

Doerre, W. H.
A STUDY OF THE OPTIMUM SELECTION OF PARAMETERS FOR DUST MEASUREMENTS. (Beitrag zur optimalen Auswahl von Parametern bei lufthygienischen Staubmessungen). Text in German. Z. Ges. Hyg. (Berlin), 15(9):659-665, Sept. 1969. 25 refs.

Atmospheric dust is composed of diverse chemical substances. If inhaled, a certain fraction remains on the surface of the respiratory tract where it is subjected to various elimination mechanisms. During its residence time in the respiratory tract, some substances might be dissolved and not discharged. Jacobi's model of the respiratory tract, which divides into seven sections, (one upper respiratory section and six bronchial sections), was used to demonstrate the importance of some aerosol parameters to the biological effect. An aerosol consisting of 1g/cc spherical particles of biologically inactive and active substances was selected for the study. From the literature, it can be assumed that almost all biologically active

substances are dissolved in the respiratory tract at solution half-times of several days. Comparison of quantities of dissolved dust in the bronchial and upper respiratory sections shows that at low solution rates, most of the dust is found in the upper respiratory tract; at high rates, most is found in the bronchial sections. In the majority of cases, the maximum surface load can be found in the bronchial sections. To show the influence of aerosol distribution, cigarette smoke and the natural aerosol were used for a numerical estimate. A distinction was made between mass-proportional and surface-proportional concentration of the biologically active material. It is concluded that this model can be used for relating carcinogenic hydrocarbons in the atmosphere and the frequency of carcinoma.

6045 APTIC NUMBER 14720

Dontenwill, W., H. Elmenhorst, G. Rechzeh, H. P. Harke, and L. Stadler
EXPERIMENTAL INVESTIGATIONS ABOUT THE INTAKE, TRANSPORT, AND METABOLISM OF CANCEROGENIC HYDROCARBONS IN THE RESPIRATORY TRACT. (Experimentelle Untersuchungen ueber Aufnahme, Abtransport und Abbau cancerogener Kohlenwasserstoffe im Bereich des Respirationstraktes). Text in German. Verhandl. Dent. Ges. Pathol. (Stuttgart), vol. 52:401-408, April 1968. 3 refs.

While the various methods of subcutaneous and cutaneous testing of carcinogens are standardized, the intravenous methods are not. Therefore, studies were conducted to standardize the experimental techniques and to gain information on the relationship of dose and effect, absorption and metabolism of various carcinogens in the lung. Benzopyrene (BP) and soot were administered to hamsters as suspensions (150 mg DMBA + 150 mg Fe2O3 + 10 ml NaCl solution; 150 mg BP + 150 mg Fe2O3 + 10 ml NaCl solution; and 1% BP + 1% carboxymethylcellulose (CMC) + 98% NaCl solution) and solutions (BP and DMBA in polyethylene oxide and BP in sesame oil). The Saffiotti method was used. Column chromatography and fluorimetry were used determination of the carcinogenic substances in the organs and the blood. The effects of the carcinogens on the lung depended to a large extent on the type of solution and residence time. Dissolved carcinogens remained in the lungs just for a short time so that the carcinogenic effect was diminished. Suspended carcinogens were slowly dissolved in the lung and very slowly absorbed. Thus, their long residence time enhances the carcinogenic effect. Only the benzopyrene-CMC suspension was reproducible; the hematite-benzopyrene suspension fluctuated widely so that only about 50% of the theoretical amount reached the lung.

6046 APTIC NUMBER 14711

Dontenwill, W., H. Elmenhorst, G. Rechzeh, H. P. Harke, and L. Stadler
STUDIES ON THE REMOVAL AND CATABOLISM OF CANCEROGENIC HYDROCARBONS IN THE RESPIRATORY TRACT OF GOLDEN HAMSTERS EXPOSED TO SMOKE. (Experimentelle Untersuchungen ueber die Beeinflussung von Abbau und Abtransport cancerogener Kohlenwasserstoffe im Bereich des Respirationstraktes durch passive Berauchung von Goldhamstern). Text in German. Z. Krebsforsch., 72(1):53-68, 1969. 2 refs.

Three groups of male golden Syrian hamsters were studied: (1) hamsters not exposed to smoke which received a single intratracheal injection of 500 micrograms of 3,4-benzopyrene in carboxymethylcellulose; (2) hamsters exposed three times a day, 5 days a week, for 10 min to cigarette smoke (equivalent to 40 cigarettes each time), and receiving an intratracheal injection of benzopyrene after four weeks of exposure; and (3) hamsters exposed for four weeks to cigarette smoke prior to and following administration of benzopyrene until killed. The times from administration of benzopyrene to killing of the animals were 3 min, 8 hrs, and 7, 8, 9, and 12 to 20 days. The results show that there is no clear difference in the removal from the lungs and catabolism of 3,4-benzopyrene in smoke-exposed and non-exposed animals.

6047 APTIC NUMBER 15770

Dubois, Arthur B.
MECHANISM OF BRONCHIAL RESPONSE TO INHALANTS. Environ. Res., 2(5-6):397-403, 1969. 42 refs.

The mechanisms of functional bronchial response to inhalants are discussed. Although reflex bronchoconstriction mediated by vagal afferent and efferent fibers must be an important mechanism in bronchoconstriction after the inhalation of small amounts of dust or sulfur dioxide and other gases, it cannot be the sole mechanism. Mechanical alterations of the lungs were found in isolated, perfused lungs and after vagal section or after lungs exposed to dust were removed from the body. The degree of bronchial response to inhalants depends on the amount of substances administered, probably following an S-shaped dose-response curve. The effect of inert dust particles occurs regularly and is easily demonstrated, provided the methods used to measure the effects are appropriate. Measurements of airway resistance by means of a body plethysmograph, or pulmonary resistance by the esophageal pressure method, are most suitable. The phenomenon of bronchoconstriction after dust or sulfur dioxide exposure appears to have a strong reflex component in which the receptors are similar to the touch, pain, or cough receptors in the trachea and bronchi. The afferent nerves accompany the vagus, and the efferent pathways are vagal, resulting in constriction of the smooth muscle in the trachea and bronchi. The fact that excised lungs show a response to inhalation of dust particles must mean that additional local mechanisms come into play. The release of histamine and acetylcholine and the action of dust on surface tension forces of the lungs was postulated.

6048 APTIC NUMBER 15731

ERMAKOV, P. V. and B. F. Murashov
ON THE MECHANISM OF TETRAETHYL LEAD ACTION. (K voprosu o mekhanizme deystviya tetraetilsvintsa). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 7:53-58, 1969.

Studies were conducted at the Pirov Military-Medical Academy to evaluate the effects of tetraethyl lead (TEL) on the neuroendocrine system. Four hundred patients were examined. Electroencephalograms were conducted on 103 patients; 78 showed EEG deviation. Focal affectation of the brain was not detected. However, 31 patients showed a decrease in or total loss reaction to light; 32 patients showed a decrease in or total loss of reaction to sound; and 6 patients showed inverted reaction to light and sound.

6049 APTIC NUMBER 10440

Ferris, Benjamin G., Jr.
CHRONIC LOW-LEVEL AIR POLLUTION. USE OF GENERAL MORTALITY, AND CHRONIC DISEASE MORBIDITY AND MORTALITY TO ESTIMATE EFFECTS. Environ. Res., 2(2):79-87, Feb. 1969. 19 refs.

General mortality data are probably too insensitive to estimate effects of chronic low-level air pollution. Morbidity data are better, especially if designed as prospective epidemiological studies. It appears that the most sensitive approach is to use simple tests of pulmonary function as an index of disease. One restriction involves defining the type of air pollution, since not all types or constituents act in a similar manner. The constituents and their range levels must be identified. Also, the level of tobacco usage for a population and occupational exposures must be known and taken into account. Further work is indicated to identify the most sensitive of existing tests of pulmonary function for field surveys.

6050 APTIC NUMBER 10377

Freeman, Gustave, Sheldon C. Crane, Robert J. Stephens, and N. J. Furiosi
ENVIRONMENTAL FACTORS IN EMPHYSEMA AND A MODEL SYSTEM WITH NO2. Yale J. Biol. Med., 40(5-6):566-575, April-June 1968. 44 refs.

A model of an emphysema-like disease based on the covert effects of environmental NO2 is described. The model suggests how some of the features that define emphysema in man may occur. Twenty-one month-old rats were exposed to concentrations of 0.8 ppm of NO2, a level already achieved in smog. They and an equivalent control group lived out their natural lives of 2-3 years and died of similar commonplace diseases of old age apparently unrelated to NO2 exposure. The only difference between the groups was a sustained tachypnoea of about 20% above normal in rats exposed to NO2. Microscopically, lungs were essentially without blemish except for occasional evidence of bronchial epithelial changes. A similar experiment with 2 ppm of NO2 produced the same results. The bronchial epithelial cells exposed to NO2 were more uniform in size and the lumenal surfaces were smoother than in the controls. Functionally, it was suggested that inhaled particles, infections or not, might be retained due to deficient ciliary cleansing of alveoli and bronchioles. The next higher concentration, 4 ppm, was terminated after 16 weeks. Grossly, the lungs were not clearly different from the controls, but the terminal bronchiolar epithelium was hypertrophic, characterized by increased height and uniformity of the cells. In all cases, continuous breathing of 10 ppm NO2 gave rise to large, air-containing lungs that did not collapse under atmospheric pressure. Animals exposed to 10 ppm began to die of respiratory failure after 16 months. They grew less well and developed thoraces with increased anterior-posterior diameters. Lungs of rats dying of exposure to 12 or 25 ppm NO2 looked alike, except that the longer survival of 16-30 months of the former allowed changes in them to become more advanced than in rats that died after 5-6 months from 25 ppm. It was concluded that by selective timing and dosage of NO2, lesions of the lung may be achieved that resemble more closely the generalized destructive, bullous-forming stage of the disease recognized by many pathologists as the determining symptom of terminal emphysema in man.

6051 APTIC NUMBER 15215

Freeman, G., S. C. Crane, and N. J. Furiosi
HEALING IN RAT LUNG AFTER SUBACUTE EXPOSURE TO NITROGEN DIOXIDE. Am. Rev. Respirat. Disease, 100(5):662-676, 1969. 13 refs.

The nature of healing was observed in rats after 1, 4, 10, 16, and 20 weeks of continuous exposure to 15 + or - 2 ppm nitrogen dioxide. Animals from each group were allowed to recover for 0, 8, 20, and 52 weeks and were compared with control rats of the same age. Lung weights increased at two different times as compared with those of the control animals. The first was associated with hypertrophy of bronchiolar and adjacent alveolar epithelium. This tended to return toward normal during recovery. The second occurred in aging, recovering rats, long after contact with NO2 had ceased. This was consistent with an increase in the staining property of collagen and elastic tissue in the alveolar parenchyma, which was most noticeable in the ductal areas. Between the two increments, lung weights were equivalent to those of control animals. Healing in the longer-exposed rats left some inhomogeneity of the air spaces of the parenchyma and some partial or possibly complete closure by fibrosis of the terminations of the bronchioles. Septal walls were sometimes attenuated and fractured. Both atresia of terminal bronchioles and discontinuities in altered elastic tissue may account in part for the apparently reduced elastic recoil of lungs of exposed animals. (Author summary modified)

6052 APTIC NUMBER 14540

Fritze, P., P. Gundel, P. Ludwig, G. Mueller, H. O. Mueller, and P. Petersen
THE HEALTH SITUATION OF MINERS OF A COAL MINE. (Die gesundheitliche Situation von Bergarbeitern einer Kohlenzeche). Text in German. Deut. Med. Wochschr., 94(8):362-367, Feb. 21, 1969. 37 refs.

The tuberculin sensitivity and the radiologically-determined condition of the lungs of 1700 'healthy' coal miners were analyzed for different age groups. Categories of miners with

and without pneumoconiotic lung modifications were compared with a group not exposed to dust and a group of retired miners with severe pneumoconiosis, and the occurrence of rheuma factors and serum-complement titers was determined. The analysis yielded an above-average incidence of tuberculosis even in the youngest group of miners, a frequency of identification of rheuma factors in 11.3% of the miners (or 16%, if the group with severe silicosis is included), as well as lowered complement titers compared with a non-mining group. The frequency of occurrence of the rheuma factors and the lowering of the complement titer does not correlate with the presence of pneumoconiotic changes of the lungs but is likely to be connected with the dust loading.

6053 APTIC NUMBER 18585

Frost, Gordon, C. Willet Asling, and Marjorie M. Nelson
SKELETAL DEFORMITIES IN MANGANESE-DEFICIENT RATS. Anat. Record, Vol. 139, p. 47-53, 1959. 10 refs.

The production of skeletal deformities in high incidence in young rats born of manganese-deficient mothers is discussed. Only 55% of the manganese deficient young survived to weaning in comparison with 96% of the young on a manganese-supplemented diet. Shortening and bowing of the forelegs was observed in 70% of the animals at 30 days and in 90% at 60 days. Roentgenograms showed that this was due to a dysostosis of the radius and ulna, a short distal ulnar segment and a long olecranon process. Histologic studies of the radius, ulna, and tibia revealed retardation in osteogenesis and in maturation, but gave no adequate explanation for the defect as seen grossly. Perforation of the proximal tibial epiphyseal cartilage plate occurred in animals 30 and 60 days old.

6054 APTIC NUMBER 15672

Goldsmith, John R.
CARBON MONOXIDE. Science, 157(3790):842-848, Aug. 18, 1967.

Epidemiologic and experimental studies of carbon monoxide are reviewed. The increase of hematocrit found in coal miners and smokers may involve a carbon-monoxide mechanism. Smokers show an increased hematocrit within minutes and also over long periods. The short-term change is easily reversible but the long-term change only partially reversible. The possible association between increased hematocrit and increased likelihood of clot growth may explain the high cardiovascular mortality among cigarette smokers. Other important effects of carbon monoxide are interference with oxygen transport to tissues; the impairment of sensory and psychomotor functions; and the interference with heme catabolism or red blood cells. Further research is needed on the role of carbon monoxide in regulating the body's circulating red cells and on the effects of both environmental pollution and smoking. It may be possible to estimate carbon monoxide exposures in populations through the study of carboxyhemoglobin since the human respiratory and circulatory system is a type of integrating sampler. Available evidence suggests that carbon monoxide is removed from the atmosphere through oxidation by hydroxy radicals, oxygenated substances, or molecular oxygen to carbon dioxide.

6055 APTIC NUMBER 15613

Hasegawa, Yutaka
A STUDY ON THE HEALTH EFFECTS OF AIR POLLUTION ON SCHOOL CHILDREN. (Taiki osen ga gakudo no kenko ni oyobosu eikyo ni tsuite). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(3):147-155, 1969.

School districts were chosen from the Osaka, Yokkaichi, and Ichihara areas and were studied for three years. Medical examinations included respiratory organ tests, lung X-rays, vital capacity, and others. The dust jar, tape air sampler, digital dust meter, and high-volume air sampler were used to measure the air. Two schools were chosen from each district, one in a polluted industrial area and the other in the suburbs. Dust fall was determined in the three areas as 12.4 tons/sq km/mo in the polluted area and 5.9 tons/sq km/mo in the suburbs. The sulfur trioxide emission in Osaka was 1.6 mg SO_3 day/100 sq cm in the polluted area and 0.6 mg SO_3 day/100 sq cm in the suburbs. Many students in the polluted area complained about the smoke and its health effects, especially in breathing. In medical tests, inflammation of the throat was serious in children from all polluted districts, as exemplified by 44% inflammation in the polluted areas as compared with 9.7% in the suburbs in Yokkaichi.

6056 APTIC NUMBER 14862

Hasegawa, Misako
EPIDEMIOLOGIC STUDY OF CHRONIC SINUSITIS WITH SPECIAL EMPHASIS ON THE MASS EXAMINATION METHOD AND FACTORS RELATED TO DEVELOPING THE DISEASE. (Mansei Fukubikuan no ekigakuteki kenkyu-Tokuni Shudan Kenshinho no Kento to Hassho Yoin ni tsuite). Text in Japanese. Chiba Igakkai Zasshi (J. Chiba Med. Soc.), 43(5): 688-706, 1968. 41 refs.

A large number (1646) of students from 19 elementary schools in Chiba Prefecture were examined for chronic sinusitis by questionnaires, nose mirrors, and x-rays. For studying the relation between air pollution and sinusitis, dust in the students' bedrooms at home was collected by a slide glass smeared with liquid paraffin. The glass was examined by microscope for mineral, fiber, and pollen dusts. Contrary to expectations, little correlation was found between air pollution and chronic sinusitis, and even allergy was not related to sinusitis. Those factors which were found to relate to sinusitis included nourishment, nose Pn, and climate. Differences between urban and rural environments were not as great as had been thought, probably because of the method of examination and the diminishing difference between the way of life in the two types of areas. The importance of careful evaluation of the tests in this kind of study is emphasized, and a suggestion is made for preventing chronic sinusitis in Japan.

6057 APTIC NUMBER 13744

Hassanein, M., M. A. Ghaleb, F. A. Haroun, M. P. Hegazy, and M. A. M. Khayyal
CHRONIC MANGANISM: PRELIMINARY OBSERVATIONS ON GLUCOSE TOLERANCE AND SERUM PROTEINS. Brit. J. Ind. Med. (London), vol. 23:67-70, Jan. 1966. 25 refs.

An intravenous glucose tolerance test was carried out in 11 patients with chronic manganese poisoning. Prolonged reactionary hypoglycemia was observed, suggesting an impairment of adrenal function. This might be due to a primary functional lesion in the adrenal cortex or to a secondary effect of a disturbance in the hypothalamo-pituitary-adrenal axis. Prolonged reactionary hypoglycemia might, together with other, factors, profoundly influence the physiological function of the central nervous system. It is hypothesized that a feedback mechanism operates by means of which the initial disturbance causes hypoglycemia, which in turn increases the disturbance. Total serum proteins were estimated in patients and separated electrophoretically. The albumin: globulin ratios were lower in patients than in healthy individuals of the same age. There were significant reductions in serum albumin concentrations of alpha-1 beta globulins. The disturbance of the serum protein patterns may be a reflection of liver involvement.

6058 APTIC NUMBER 15345

Hayata, Yoshihiro, Kenkichioho, and Yuji Saito
AIR POLLUTION AND LUNG CANCER. (Taiki osen to haigan). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):9-15, Sept. 1969. 36 refs.

The relationship of lung cancer to cigarette smoking was investigated among workers in an industrial city with special emphasis on the types of cancer peculiar to some occupations. Among the total number of subjects with lung cancer (8688), 88.3% of the males and 21.1% of the females were cigarette smokers. The relationship of cancer types to smoking habits was the following: 25.8% of the non-smokers, 48.2% of the light smokers, and 87.8% of the heavy smokers had squamous carcinoma; 49.8% of the non-smokers, 32.2% of the light smokers, and 25.6% of the heavy smokers had adenocarcinoma; and 24.8% of the non-smokers, 23.6% of the light smokers, and 26.6% of the heavy smokers had amorphous-type carcinoma. Squamous carcinoma originates in the basal cells of the bronchial mucosa due to specific irritations. A cigarette smoker's bronchial mucosa, when cancerous, typically contains a mixture of partly metasticizing, partly destroyed and desquamating cells, and amorphous cells, and presents a means of identifying cancer due to smoking. The highest death rates from cancer were found in the most industrialized cities, such as Tokyo, Fukuoka, and Yokohama. 3,4-Benzopyrene is considered a carcinogen; in Okunoshima, where mustard gas has been produced for 19 years, a tremendous number of bronchial cancer cases was found. Another study of the mining industry showed a relationship between organic dusts and pneumonia and lung cancer.

6059 APTIC NUMBER 13723

Hellung-Larsen, P., T. Laursen, K. Kjeldsen, and P. Astrup
LACTATE DEHYDROGENASE ISOENZYMES OF AORTIC TISSUE IN RABBITS EXPOSED TO CARBON MONOXIDE. J. Atherosclerosis Res. (Amsterdam), vol. 8:483-489, March/April 1968. 15 refs.

Isoenzymes of lactate dehydrogenase (LDH) are tetramers of two different polypeptide subunits, H and M. In general, the LDH pattern of tissues with high aerobic metabolism has a predominance of H subunits, while preferentially anaerobic tissues are dominated by M subunits. The mechanisms for the regulation of synthesis and catabolism of H and M subunits were investigated by exposing nine out of sixteen male rabbits to low concentrations of carbon monoxide for up to 11 days. The remaining rabbits served as controls and were kept in room air. Lactate dehydrogenase isoenzymes of arch, thoracic part, and abdominal part of aorta and of heart, lung, and liver tissues were analyzed to determine the extent to which induced tissue hypoxia evoked an increase in the polypeptide H subunits of the LDH pattern. Changes of the LDH pattern were observed only in the aortic arch, where a significant decrease in the percentage of polypeptide H subunits was found in the experimental animals. It is concluded that carbon monoxide induces a change in the LDH pattern of the aortic arch toward a higher percentage of M subunits. This change may reflect alterations of the arterial tissue preceding the development of arteriosclerotic lesions.

6060 APTIC NUMBER 16119

Heuss, Jon M. and William A. Glasson
HYDROCARBON REACTIVITY AND EYE IRRITATION. Environ. Sci. Technol., 2(12):1109-1116, Dec. 1968. 21 refs.

Twenty-five hydrocarbons and nitric oxide were irradiated in a smog chamber. Eye irritation and various chemical reaction rates and product yields were used to measure hydrocarbon reactivity. Although the chemical measurements of reactivity correlated with one another to a fair degree, there was no correlation between any of the chemical measurements and eye irritation. A correlation was found between hydrocarbon structure and eye irritation; a hydrocarbon reactivity scale based on eye irritation is presented. The most potent precursors of eye irritation were benzylic hydrocarbons and aromatic olefins. A new and extremely potent eye irritant, peroxybenzoyl nitrate, a lachrymator 200 times as potent as formaldehyde, was identified as a product from the irradiation of benzylic hydrocarbons and aromatic olefins. (Author abstract modified)

6061 APTIC NUMBER 15899

Holland, George J., David Benson, Albert Bush, George O. Rich, and Robert P. Holland
AIR POLLUTION SIMULATION AND HUMAN PERFORMANCE. Am. J. Public Health, 58(7):1684-1691, Sept. 1968. 35 refs.

The effect of short-term exposure to moderate levels of photochemical air pollutant constituencies on the efficiency of

various types of human motor performance was determined. Reaction time, vital capacity, and submaximum work performance on the bicycle ergometer were measured in 18 college student volunteer subjects. The subjects were randomly assigned to one of two groups according to the latin square method of experimental design. They served alternately on two occasions as either control subjects in a normal atmospheric environment or as experimental subjects in an air pollution environment. In order to simulate the conditions of the Los Angeles Basin, a test facility was designed. Irradiated exhaust gases from an automobile were pumped into an exercise booth near the reaction tunnel. A ventilation system was used to replace the exhaust gases with filtered atmospheric air during the control experiments. Air samples were analyzed for carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, oxidants, hydrocarbons, aldehydes, and formaldehyde. It did not appear from the study that the performance of fine neuromuscular tasks such as reaction time or cardiorespiratory work efficiency were significantly altered by short-term exposure to moderate levels of air pollution. More study is required to elucidate the effects of air contaminants on other types of human psychomotor performance, especially maximum work capacity. Many atmospheric pollutants may have an insidious qualitative biochemical effect on human physiological processes which can only be identified through careful longitudinal study. Future studies involving higher levels of contamination with more precise measures of airway resistance are recommended.

6062 APTIC NUMBER 18682

Horn, E.
ON THE EFFECTS OF AIR POLLUTION ON THE POPULATION. A NEW REVIEW. (Ueber die Auswirkung der Luftverunreinigung auf die Bevoelkerung. Eine neuere Uebersicht). Text in German. Z. Ges. Hyg. (Berlin), 14(6):410-411, June 1968. 28 refs.

A review of the known effects of air pollution on human health is presented. In polluted areas, the mortality rate from diseases of the respiratory tract is nine times higher than in rural areas. A linear relationship was found to exist between the smoke content of the atmosphere and diseases of the respiratory tract and the circulatory system. The disease rate of female employees of radio stations in five U. S. cities also showed a relationship between diseases of the respiratory tract and air pollution. A connection between the physical condition of school children and the content of free silicon dioxide in atmospheric dust was found in the USSR. Japanese studies also confirm an increased occurrence of diseases of the respiratory tract and the eyes in polluted areas. In an industrial area with heavy smoke and dust pollution but low SO2 pollution, Czech scientists found lower hemoglobin concentrations but considerably higher alkaline phosphatase concentrations and a high incidence of rickets in children. In a heavily SO2-polluted area of northern Bohemia, children had considerably higher numbers of erythrocytes but less hemocrit. According to other Czech studies, the bone development of children living in heavily polluted areas was retarded.

6063 APTIC NUMBER 18753

Ichinosawa, A., H. Takahashi, Y. Tsunetoshi, and T. Shimizu
ETIOLOGICAL CONSIDERATIONS WITH RESPECT TO CHRONIC BRONCHITIS IN JAPAN. (Nippon ni okeru hansei kikanshien no byoin-teki kosatsu). Text in Japanese. Nippon Rinsho (Japan Clin.), 25(9):2058-2063, Sept. 1967. 38 refs.

The etiological influence of air pollution on the incidence of chronic bronchitis is discussed. Six areas in Osaka and its vicinity were classified into three severely, one moderately, and two mildly polluted areas. Concentrations of SO2, NO2, and ozone and amount of settling dust were measured. Incidence of chronic bronchitis in the severly polluted areas was higher (twice as great in males and three times as great in females) than that in the mildly polluted areas. Males were more frequently and severly involved than females. Smoking and SO2 concentration were the most important causes of this disease in any district, and the correlation between the concentration of SO2 and occurrence of chronic bronchitis was demonstrated mathematically. In younger age groups, certain constitutional factors influence the occurrence of the disease, while in older age groups, environmental factors are more influential. It was difficult to determine the minimal predisposing conditions necessary to provoke chronic bronchitis, since there were so many variations in physical conditions among the subjects.

6064 APTIC NUMBER 18898

Imamura, S., F. Momiyama, and H. Matsui
PUBLIC NUISANCE DUE TO ORGANIC SOLVENTS AND PROPANE GAS (LPG). (Yuki yo zai oyobi ekika gas ni yoru kogai no ichi rei). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):89, April 1969.

Because of complaints about offensive odors emanating from a factory producing propane gas and organic solvents on days when wind direction was southeasterly, simultaneous investigations were undertaken to measure mercaptan, butyl acetate, and toluene levels inside and outside the factory and the effect of these compounds on factory workers and residents of the area. The surveys were carried out on a day when the prevailing wind was southeasterly. Workers and residents were examined for subjective and clinical symptoms, the latter including liver swelling, pharyngeal inflammation, inflammation of the eye and conjuctiva, and the urobilinogen, albumin, sugar, and hippuric acid content of the urine. In the factory, methyl mercaptan levels did not exceed 0.2 ppm and butyl acetate 20 ppm. Outside the factory, toluene did not exceed 0.1 ppm, methyl mercaptan 0.2 ppm, and butyl acetate 5 ppm. At an exit of an organic solvent washer, 100 ppm toluene was found but was attributed to a defect in the washer's design. Comparison of the subjective and clinical symptoms with those of a control group suggests that the rate of positive urobilinogen and abnormal discharge of hippuric acid in urine of people living near the factory is higher. Residents living within 30 m downwind of the factory exhibited an abnormally high discharge of hippuric acid. Workers also showed higher rates of positive urobilinogen and an abnormal discharge of hippuric acid.

6065 APTIC NUMBER 13619

Yrzhanov, S. P. and Kh. Zh. Zhumatov
USE OF ORGAN CULTURES FOR STUDY OF RESPIRATORY DISEASES. A PRELIMINARY REPORT. Translated from Russian. Vop Virus, No. 2:246-250, 1968. 18 refs.

Significant advances in the diagnosis of respiratory viral diseases have been made using cell and tissue cultures. This paper discusses the materials and methods used, and gives the results of two (2) experiments using the lungs of guinea pigs. It is concluded that organ cultures of lungs of embryos of laboratory animals and of man may serve as one of the models possible for experimental study of the histopathology of pulmonary infections by acute respiratory virus diseases. This likewise concerns the pathogeny of mixed viral-bacterial pneumonia. Organ cultures permit the revealing of character changes in alveolar epithelia and in the walls of the bronchioles in the first hours and days of contact with the virus, with the architectonics of the lung tissue being preserved.

6066 APTIC NUMBER 18693

Jonderko, Gerard and Zbigniew Szczurek
PATHOMORPHOLOGICAL STUDIES OF INNER ORGANS IN EXPERIMENTALLY INDUCED MANGANESE POISONING. (Pathomorphologische Untersuchungen innerer Organe bei experimenteller Manganvergiftung). Text in German. Intern. Arch. Gewerbepathol. Gewerbehyg. (Heidelberg), 23(2):106-116, 1967. 25 refs.

Fifteen male rabbits aged 6 to 12 months received daily intravenous doses of 3.5 mg manganese as 1% MnCl2 in 0.15 M NaCl solution for up to 32 days. Symptoms began to appear after the first week. The animals became excited and aggressive. This stage was followed by apathy and refusal to eat. At the end of the intoxication period, tremors of the head and legs were observed in two rabbits, two had equilibrium difficulties, one salivated, and three had died. All animals were decapitated, including the five control animals. One hour after death, tissue samples were taken from the liver, spleen, lung, kidneys, large intestines, pancreas, adrenal glands, and the scrotum. Pathomorphological changes were found in all organs. They were filled with blood and hyaline thrombosis was diagnosed. The largest changes were found in the liver parenchyma. Various degrees of decay to necrosis were found, accompanied by inflammation. The microscopic pictures looked similar to acute liver cirrhosis. The kidney and the large intestines were the least damaged organs. Degeneration of the nephrons and inflammation of the mucous membrane were seen. The toxicity of manganese to several organs can be explained by its toxic effect on the central nervous system and on the blood vessels.

6067 APTIC NUMBER 18656

Fukita, Shigetoshi
A STUDY OF MASS SURVEYS TOKYO METROPOLITAN GOVERNMENT EMPLOYEES FOR PULMONARY CANCER. (Tokyo tocho ni okeru haigan shudan kenshin no kenkyu). Text in Japanese. Nippon Kyobu Geka Gakkai Zasshi (J. Japan Assoc. Thoracic Surg.), 16(11):1144-1162, Nov. 1968. 39 refs.

Between 1953 and 1966, 93 cases of pulmonary cancer were discovered among a total of 838,196 employees of the Tokyo Metropolitan Government who underwent periodic mass chest X-rays. These cases are clinically analyzed. The incidence of pulmonary cancer was 11.1 per 100,000. Among the 315,142 employees who were forty and older, the incidence per 100,000 was 29.9. With respect to different age groups, the incidence per 100,000 was 0.4 among those under 40; 6.4 among those between 40 and 49; 29.8 among those between 50 and 59; and 112.3 among those 60 and older. A correlation was found between pulmonary cancer incidence and air pollution in terms of chimney dust fall. Only 14% of the cases of pulmonary cancer exhibited no symptoms; the remainder showed such symptoms as coughs, sputum, and bloody sputum. As revealed by X-rays, 16.1% of the subjects had coin lesions and 47.6% had nodular-type lesions. Of the discovered cancer cases, 68.4% underwent resection, which was radical in 19.8%. These cases were divided into three groups: (1) those who had been checked twice a year; (2) those who had been checked once a year; and (3) those who had not been checked in the previous year, or who had been checked but not correctly diagnosed. Radical resection was performed in 88.9% of group 1, in 41.2% of group 2, and in 24.2% of group 3. Those who survived five years after resection accounted for 50% of group 1, 30.7% of group 2, and 25.0% of group 3. Biannual mass X-rays are recommended for the early detection of pulmonary cancer. (Author abstract modified)

6068 APTIC NUMBER 18681

Kodama, T., S. Masuda, M. Nishikawa, M. Hayashi, T. Hattori, and A. Ishida
HARMFUL INFLUENCE OF AIR POLLUTION ON CHILDREN'S HEALTH. I. VENTILATORY FUNCTION OF PUPILS IN YOKKAICHI. (Taiki osen no shoni ni oyobosu eikyo. I. Jido no kankikino ni oyobosu eikyo Yokkaichi-shi). Text in Japanese. Nippon Shonika Gakukai Zasshi (Acta Pediat. Japan.) (Tokyo), 70(12):1299-1307, 1966. 41 refs.

Comparative investigations of the respiratory functions of pupils were made on 1080 pupils from Shibaura Elementary School, where the air was maximally polluted (maximum SO2 concentration was once 2.5 ppm) and on 290 pupils of Sakura Elementary School, where air pollution was considered to be minimal. Routine physical examinations and tests of respiratory functions, especially ventilatory functions, using Wright's peak flow meter and respirometer of vitalor type were done every two to five months from Dec. 1964 to Feb. 1966. Chronic reduction of ventilatory functions, especially obstructive disease as shown by the decrease of peak flow rate, FVC, MMFR, AND FVC, was observed in pupils 6 to 12 years old in the polluted area. This phenomenon was more marked in winter when the air was cold and dry. The difference in the severity of ventilatory disturbance became smaller, especially among females, with increase in age. Reduced ventilatory function was also seen sporadically, and

this fact may also suggest a constitutional predisposition to the disease. With precise examination, including radiological studies, the ventilatory disturbances were shown to be due to chronic inflammation of both upper and lower respiratory tracts.

6069 APTIC NUMBER 15383

Krueger, A. P., P. C. Andriese, and S. Kotaka
SMALL AIR IONS: THEIR EFFECT ON BLOOD LEVELS OF SEROTONIN IN TERMS OF MODERN PHYSICAL THEORY. Intern. J. Biometeorol. (Leiden), 12(3):225-239, 1968. 25 refs.

The relationship between air ion density and the blood levels of 5-hydroxytryptamine (5-HT) in mice was studied. Eight-week old male mice were kept in cylindrical plexiglass holding chambers and exposed to ionized atmospheres for varying amounts of time. Under stringently controlled environmental conditions in which only the small air ion content of the ambient air was varied, positive ions raised blood levels of 5-HT in the mouse and negative ions depressed them. Examination of the experimental evidence in terms of the modern physical theory of air ion formation and composition led to the hypothesis that the ions H(+)(H2O) and (H3O)(+)(H2O)n were the physiologically active constituents of positively ionized air, while O2(-)(H2O)n and OH(-)(H2O)n were the active agents in negatively ionized air. Further tests were conducted with positive molecular ions of CO2, O2 and N2 and with negative molecular ions of CO2 and O2 emitted separately into pure air containing water vapor. The effects on the blood level of 5-HT in mice support the initial hypothesis and are in accord with physical theory.

6070 APTIC NUMBER 15725

Krueger, A. P. and S. Kotaka
THE EFFECTS OF AIR IONS ON BRAIN LEVELS OF SEROTONIN IN MICE. Intern. J. Biometeorol., 13(1):25-38, 1969. 42 refs.

Experiments performed to determine the influence of high, moderate and low densities of positive or negative air ions on serotonin (5-hydroxytryptamine, a neurohormone) in mice are described. Mice were placed in a controlled pollutant-free microenvironment and exposed for 12, 24, 48, and 72 hours to 3 different concentrations of small positive or negative air ions. The concentrations were 2000-4000 ions/cu cm, 30,000-40,000 ions/cu cm, and 350,000-500,000 ions/cu cm. Spectrofluorometric assays of brain serotonin levels of air ion-treated mice showed statistically significant differences as early as 12 hrs from those of mice kept in untreated pollutant-free air. Essentially no deviation from control values were observed at 24 and 48 hours. After 72 hours of exposure sharp decreases took place in all groups with the single exception of the animals exposed to 30,000-40,000 positive ions/cu cm. The hypothesis that alterations in mood and affect associated with certain meteorological conditions might depend upon air ion-induced changes in brain levels of serotonin was examined in the light of recent advances in neurophysiology and neuropharmacology. Since the air ion content of the atmosphere is the only known variable associated with shifts in serotonin in the brain, the hypothesis was accepted. This does not signify the attainment of insight into a reasonable physiological mechanism which would account for the uniformity of serotonin reduction brought about by ions of either charge and by varying dosages of these ions, nor was there a satisfactory correlation established between reported air ion effects on mood, affect or behavior, and air-ion induced alterations of serotonin in the brain.

6071 APTIC NUMBER 15503

Lefevre, G., J. C. Menot, J. Lafuma, A. Collet, and J. Charbonnier
A METHOD OF INDIVIDUAL DETERMINATION OF PULMONARY CLEARANCE IN ANIMALS BY MEANS OF RADIOACTIVE AEROSOLS. (Methode d'etude individuelle de l'epuration pulmonaire chez l'animal par aerosols radioactifs). Text in French. Arch. Maladies Profess. Med. Trav. Securite Sociale, 29(12):669-678, Dec. 1968. 33 refs.

A brief review of lung clearance of particles deposited by inhalation is followed by a description of a new test apparatus for determination of lung clearance of cats. Radioactive dusts are inhaled through the nose and rhinopharynx of the narcotized test animal. The inhalation device, the method of measuring the total radioactivity, and the device for determination of radioactivity distribution in the body of the test animal are described. A few illustrative test results obtained with this apparatus are given. Two graphs of clearance curves, obtained by plotting the intensity of global radioactivity vs. time on a logarithmic scale after exposure on a linear scale, exhibit an initial rapid decrease which slows to a constant rate which is reproducible in successive tests on the same animal. A third graph shows the radioactivity profile of a cat initially, 22 hrs, 3 days, and 7 days after exposure, exhibiting the progressive redistribution of radioactive particles through the head, lungs, and abdomen of the test animal. Interpretation of the initial rapid decrease in lung clearance is difficult, and the total anesthesia of the test animal required by the present method precludes the possibility of obtaining many radioactive profiles.

6072 APTIC NUMBER 13953

Lindberg, Walter
AIR POLLUTION IN NORWAY. III. CORRELATIONS BETWEEN AIR POLLUTANT CONCENTRATIONS AND DEATH RATES IN OSLO. (Den almennelige luftforurensning i Norge. III. Korrelasjoner mellom luftforurensninger og dodelighet i Oslo.) Translated from Norwegian. Oslo Univ. (Norway), p. 78-102, 1968. 92 refs.

Extensive data are presented to show the correlation of air pollution in Oslo, Denmark and death rates. The data include causes of death, types of pollutants, SO2 concentration, and meteorological factors. The results indicate a casual connection between mortality and air pollution. More investigations are recommended.

6073 APTIC NUMBER 15082

Los Angeles County Med. Assoc. Calif.
APPLY BRIEF ON THE LOS ANGELES COUNTY MEDICAL ASSOCIATION. (Presented before the U. S. Federal Power Commission in the Matters of Transwestern Pipeline Co., Docket nos. CP63-204, CP64-91; El Paso Natural Gas Co., Docket no. CP64-76; and Gulf Pacific Pipeline Co., Docket no. CP63-223, 25 p., Aug. 2, 1965.)

In arguing against oil producers and in favor of increased availability of sufficient supplies of natural gas to end industrial fuel-oil burning, it is pointed out that not only sulfur oxides but nitrogen oxides, sulfates, and submicron particulate matter, are contaminants derived from oil burning, and that these emissions constitute a serious health hazard. Industrial hygiene exposure limitations are not considered applicable to exposure of the general population to ambient air, and no single research experiment or epidemiological study can establish that a particular concentration is a safe level under any and all circumstances. In addition, it is felt that California state standards do not establish a safe atmospheric limit for community air pollutant concentrations and require modification in the light of recent findings. Los Angeles levels of SO2, NO, and particulates are considered harmful despite selected monthly averages showing 'harmless' levels; such monthly averages do not present a true picture of pollutant concentrations to which a population has been exposed. Clinical and epidemiological evidence indicates that present levels of air pollution in Los Angeles pose a serious risk to public health; it is believed that such considerations demand the elimination of pollution from industrial fuel oil burning.

6074 APTIC NUMBER 15771

Loudon, Robert G., Linda B. Rumgarner, Jacqueline Lacy, and Gary K. Coffman
AERIAL TRANSMISSION OF MYCOBACTERIA. Am. Rev. Respirat. Disease, 100(2):165-171, 1969. 15 refs.

The mechanism of the aerial transmission of disease by M. tuberculosis and atypical mycobacteria was investigated. The Henderson apparatus was used to expose mice to aerosols of mycobacterium tuberculosis and M. kansasii (photochromogenic mycobacterium) and two strains of nonphotochromogenic mycobacteria. Organisms were enumerated in the bacterial slurries before and after nebulization in a Collision nebulizer; in air samples from the equipment during nebulization; and in the lungs of animals killed at various intervals after exposure. A Goldberg rotating drum was used to test the ability of the organisms to survive aerial suspension. The mycobacteria withstood aerosolization and aerial suspension about equally well and were found in equivalent numbers in lungs from animals killed immediately after exposure. The number of organisms in lungs of animals killed three days later was approximately the same; thereafter, lung clearance rates varied considerably. By the eleventh day, the atypical mycobacteria were reduced in numbers (with the exception of the photochromogenic organism PA), but the typical tubercle bacilli multiplied. These observations show that the difference between M. tuberculosis and atypical mycobacteria with respect to transmission of disease resides in the host-parasite relationship after implantation rather than in a variation in capacity for aerial transmission or deposition after inhalation. (Author summary modified)

6075 APTIC NUMBER 18839

Mancuso, Thomas F. and J. Solon Mordell
PROPOSED INITIAL STUDIES OF THE RELATIONSHIP OF COMMUNITY AIR POLLUTION TO HEALTH. Environ. Res., 2(2):102-133, Feb. 1969.

In order to determine the relationship of air pollution to health, the Division of Special Health Services of The Public Health Service in 1955 proposed a two-part National Research program: epidemiological studies and studies of biological effects. The former study includes a determination of community air pollution and mortality and morbidity trends by residence, and community air pollution and the medically impaired. The studies of biological effects are concerned with physiological toxicological, pathological, and psychological effects of air pollution on the individual, as differentiated from epidemiological studies of patterns of effects among groups of individuals. The relationship of atmospheric pollutants to tissue culture, chick embryo, enzymes, microorganisms, the eye, and lung cancer is proposed for investigation.

6076 APTIC NUMBER 18359

Katsumura, Yukio
THE EFFECT OF SO2 UPON THE SENSITIZATION WITH ALBUMIN THROUGH THE AIRWAY IN RATS. Japan. J. Allergy, 17(9):737-744, 1968. 21 refs.

The effect of SO2 upon sensitization through the airway was investigated in rats. Animals of one group were exposed to SO2 at a concentration of 400 ppm for 30 min, then they were placed together with another group (control rats) in a chamber for the inhalation of antigen aerosols. Nebulized 1% solutions of egg albumin (EA) and bovine serum albumin (BSA) were used as the sensitizing antigens. This treatment was repeated seven times at intervals of a few days. All rats were bled four weeks after the last inhalation of antigens and their sera were stored at -25 C until serological analysis. Four techniques were used to detect antibodies against EA and BSA: double diffusion precipitin tests (Ouchterlony); passive cutaneous anaphylaxis on the skin of mice; hemagglutination tests with tannic acid and antigen-treated sheep red blood cells (Boyden); and radioimmunoelectrophoresis using I131-labeled antigen. No antibodies were detected by the first and second methods. Among 17 rats exposed to SO2, three sera showed positive hemagglutination with EA and four sera, with BSA; no sera from the 17 control rats showed positive reactions with EA or BSA. Radioautography revealed that 12 of the 15 rats exposed to SO2 and 7 of the 15 control rats, had antibodies against EA, and that 12 of the 15 exposed rats and 4 of the 15 control rats had antibodies against BSA. It may be concluded from these results that the pre-exposure to SO2 enhanced the

sensitization through the airways in rats. The possible mechanisms are discussed briefly. (Author summary modified)

6077 APTIC NUMBER 14823

Mirania, Joseph M., Virgil J. Konopinski, and Ralph I. Larsen
CARBON MONOXIDE CONTROL IN A HIGH HIGHWAY TUNNEL. Preprint. Public Health Service, Cincinnati, Ohio, Robert A. Taft Sanitary Engineering Center, 28p., May 1965. 37 refs. (Presented at the annual American Industrial Hygiene Conference, Houston, Texas, May 6, 1965.)

A 1.6-mile-long, 2-mile-high vehicular tunnel is planned for construction at Straight Creek, in the Rocky Mountains 60 miles west of Denver. Both elevation and carbon monoxide in the tunnel will tax the oxygen-carrying capacity of the blood of tunnel employees and individuals traveling through the tunnel. Unavailable hemoglobin due to elevation and carbon monoxide was calculated. It is recommended that carbon monoxide concentration in the tunnel be maintained below 50 ppm with 1-hour averages no higher than 100 ppm. Signs should be placed on the route to the pass to warn sensitive individuals of the dangers of high elevations and smoking and to suggest possible alternative, lower routes. Oxygen masks should be provided at the tunnel for emergency use. Construction workers who will be responsible for building the tunnel must be carefully screened for cardiopulmonary abnormalities, as well as blood dyscrasias. After screening the workers, a 7-14-day period of progressively increasing exercises will be necessary to obtain some degree of acclimatization. Acclimatization will be necessary before the men can work efficiently at this altitude. The men who cannot acclimatize efficiently will be the ones most likely to develop symptoms of hypoxia. Full-time tunnel employees who will be working in the tunnel should be carefully screened and evaluated. Because of the infrequency of major physical activity, their symptoms will probably be held to a minimum. (Author summary modified)

6078 APTIC NUMBER 14877

Moese, J. R., G. Fischer, and H. Brantner
STUDIES ON AIR POLLUTION IN THE GRAZ AREA. IV. ON THE MEANING OF INCREASED FLUORINE EXCRETION IN THE KIDNEY AS A MEASURE OF THE FLUORINE BURDEN OF A LARGE CITY POPULATION. (Studien ueber die Luftverunreinigung im Raume Graz. IV. Mitt.: Ueber die Bedeutung der erhoehten Fluorausscheidung im Harn als Massstab fuer die Belastung der Grosstadtbevoelkerung durch Fluorimmissionen). Text in German. Arch. Hyg. Bakteriol. (Munich), 153(3):230-238, 1969. 4 refs.

Since fluorine discharge in the urine has been found to be a good relative measure of the fluorine concentration in the atmosphere, various selected groups of the population in and around Graz were used for continuation of earlier studies. Of the four groups, one was made up of residents of the moderately populated suburbs, one of residents of an industrial section of the city, and one of residents of a densely populated residential area. The fourth group was used as control group with its members coming from a resort town located 400 to 500 m above sea level in a forested area. The highest fluorine concentrations in the urine were found in the groups from the industrial and densely populated residential areas. Average concentrations of 0.85 plus or minus 0.015, 0.91 plus or minus 0.007 and 0.63 plus or minus 0.014 mg F ions per 1000 ml urine were found in the former group and 0.85, 0.86 and 0.81 mg F ions per 1000 ml urine in the latter group. It is striking that the values of the two groups are almost the same. This can be explained by the fact that mostly coal-fired domestic heaters were used in the residential area under study. The normal value for fluorine discharge in the urine of 1 mg per 1500 ml urine per day was exceeded slightly by the majority of persons in these two groups. Although there is no danger of acute or chronic fluorine intoxication among the population in these two areas, there is clearly a higher fluorine intake from the air. This fact should be considered in the distribution of fluorine tablets or fluorine-containing toothpaste.

6079 APTIC NUMBER 15478

Moulton, D. G.
ELECTROPHYSIOLOGICAL AND BEHAVIORAL RESPONSES TO ODOR STIMULATION AND THEIR CORRELATION. Olfactologia, 1(1):69-75, 1968. 8 refs.

Differential sensitivity to and detection of odors, was considered by electrophysiological and a combination of electrophysiological and behavioral approaches in investigations involving nine male albino rats trained and tested for 11 days in a teflon-lined box. Odorants were delivered to the box through glass nozzles from an olfactometer. Electrodes were implanted in the olfactory bulb of each rat to conduct activity from the mitral cell layer of the bulb. Activity from an animal was monitored with an amplifier-transmitter circuit. The recordings of the multiunit activity of the olfactory bulb show that the relative responsiveness to exaltoloid, butyl ether, and alpha-ionone, progressively changes from the front to the rear of the bulb. Superimposed on this arrangement is a more detailed spatio-temporal pattern of response which shows no gross regional organization. The rats were trained for an odor discrimination task. Recordings of multiunit activity of the olfactory bulbs made during testing show the amplitude of the neural discharge varies as a function of the concentration of the test stimulus and of the choice, correct or incorrect, made by the rat. (Author abstract modified)

6080 APTIC NUMBER 14828

Okamoto, Yoshimichi, Hiroshi Shinagawa, and Junzo Shirai
RESPIRATORY DISEASES CAUSED BY AIR POLLUTION: SO-CALLED 'YOKKAICHI ASTHMA'. (Taikiosenkano kokyuki shikkan-ivayuru Yokkaichi zensoku no shihyo yori). Text in Japanese. Nippon Ishikai Zasshi (J. Japan Med. Assoc.), 56(3):250-256, Aug. 1, 1966. 7 refs.

Four examples of bronchitis due to air pollution are reported. The first is a middle-aged man, who lives in a slightly polluted

area. He has no lung emphysema but suffers acute temporary asthma whenever wind blows from the gasoline industrial complex. The second example is a young man who had had an atopic asthma, which was aggravated by the polluted environment. The third example is an old man who had chronic bronchitis due to heavy smoking and air pollution and which is developing into emphysema. The fourth example is a very old man who had asthma which was aggravated by air pollution and became asthmatic bronchitis. A clinical finding at the hospital is that the threshold value of the degree of air pollution which susceptible patients recognize is lower than that of healthy subjects. Finally, a study of respiratory disease of non-tubercular nature is described with some comments on the interpretation of the results.

6081 APTIC NUMBER 15921

Oshima, Hidehico, Masayuki Imai, Tokiko Kawaoishi, Katsumi Yoshiia, and Masayoshi Kitabatake
LONG-TERM EXPOSURE TO LOW CONCENTRATION OF SULFUR DIOXIDE. REPORT I. EXPERIMENTS WITH MICE. Nie Med. J., 18(3):211-215, Jan. 1969. 7 refs.

The biological effects of long term exposure to low concentrations of sulfur dioxide on albino mice were studied. Sulfur dioxide was generated by permeation from a Teflon tube in concentrations of 0.05, 0.15, and 0.23 ppm. Confirmation of the concentrations was made with p-rosaniline. The results showed that with increasing sulfur dioxide concentration, the average body weight decreased when compared to the controls. Macroscopical examination of the lungs showed a significant change. The surface was dark red in one third of the mice in the 0.23 ppm exposure group and in one half of the mice in the 0.15 ppm exposure group. Microscopical examination of the lungs showed a dark red appearance, congestion, and hemorrhage. Infiltration of inflammatory cells was also noticed. In addition, thickening of smooth muscle layers of the blood vessels and bronchi were observed in mice of the 0.15 ppm exposure group. Formation of multiple abscesses was a finding in mice dead from exposure in the 0.15 and 0.23 ppm groups. Similar formation of lung abscesses was also observed to a lesser degree in living mice in the 0.15 and 0.23 ppm groups. Histological examination of the other organs revealed a slight congestion and hypertrophy of lymph follicles in the spleen and infiltration of inflammatory cells in the heart and liver. It was concluded that the respiratory organs of mice are impaired by long term exposure to sulfur dioxide.

6082 APTIC NUMBER 14721

Otto, H., S. B. Orell, and P. Gnettich
A COMPARATIVE STUDY OF THE EPIDEMIOLOGY OF PULMONARY EMPHYSEMA. (Vergleichende Untersuchungen zur Epidemiologie des Lungenemphysems). Text in German. Praxis Pneumol., 22(8):881-887, Aug. 1968. 6 refs.

The lungs of 691 cadavers which had been continuously received from several hospitals in Stockholm for autopsy were studied to determine the frequency of emphysema. The results were compared with similar studies of 1000 lungs in Erlangen and 300 lungs in Cardiff. The lungs were expanded in toto and fixed, cut into sections and macroscopically inspected. If there was any suspicion of emphysema, paper-mounted large surface sections were prepared. On the whole, 68 (10%) cases with more or less pronounced pulmonary emphysema were found. Interestingly, the same fraction was found in Erlangen, while the frequency in Cardiff was twice as high. The male: female distribution of all emphysema cases was 8:1, which is the same as in Erlangen and Cardiff. The frequencies among various age groups again agreed very well with those found in Erlangen and Cardiff. The highest frequency was found in the 60 to 80 year group. The results clearly indicate that the cause for emphysema in the cases studied cannot be attributed to atmospheric influence.

6083 APTIC NUMBER 15206

Pagnotto, L. D. and S. S. Epstein
PROTECTION BY ANTIOXIDANTS AGAINST OZONE TOXICITY IN MICE. Experientia, 25(7):703, 1969. 11 refs.

The role of free radical injury in ozone toxicity and the practicality of chemical protection against the toxic effects of ozone and atmospheric oxidant pollutants were investigated. A total of 16 antioxidants was administered to 6-8 week old mice weighing 20-22 g. Four daily injections of 0.1 ml solutions or suspensions in saline or tricaprylin were given. Dosage of antioxidants was based on maximum sub-lethal levels which were determined by preliminary toxicity tests. Equal numbers of test and control mice were exposed to ozone for 4 hrs in two stainless steel chambers 1 hr after the last injection of antioxidant. Ozone concentrations were maintained at 9-11 ppm, producing mortalities of 80-90% in the untreated controls. Experiments were replicated using groups of 10-20 mice in each experiment. Protection by antioxidants against ozone toxicity was measured by the reduction in mortality of the test in relation to the control mice. Significant protection was produced by six antioxidants, particularly AHQ, primaquin, and PBQ. It was concluded that the practical implications of such protection should be explored.

6084 APTIC NUMBER 15537

Poetzl, K.
A RESPIRATORY TRACT MODEL AS A SIMULATOR OF RETENTION OF UNKNOWN AEROSOL MIXTURES. (Ein Atemtraktmodell als Retentionssimulator fuer gegebene unbekannte Aerosolgemische). Text in German. Experientia, Suppl., vol. 13:85-90, 1967. 6 refs. (Presented at a symposium on Atmospheric Trace Substances and their Meaning for Man, St. Moritz-Bad, Switzerland, June 18-19, 1966.)

A respiratory tract model is described which helps to determine the extent of particle retention in various parts of the respiratory tract. Moreover, it simultaneously analyzes the chemical and physical nature of the particles in the various sections. The model consists of four filters connected in series through which the aerosol-laden air is drawn. The air throughput is measured by a flowmeter and a rotameter. The filters sit on metal screens and are shielded by teflon disks. The four filters

simulate retention in the trachea, main bronchi, and the first order bronchi; in the second and third order bronchi and in the bronchioli terminalis; in the bronchioli respiratorii, ductuli alveolarii, and the sacculi alveolarii; and finally, exhalation is simulated. The model is still in the development stage. For better understanding of the functioning of the model, two examples are given.

6085 APTIC NUMBER 12279

Rogosyan, R. G.
HYGIENIC EVALUATION OF THE COMBINED EFFECTS OF ACETONE AND PHENOL IN ATMOSPHERIC AIR. In: The Biological Effects and Hygienic Importance of Atmospheric Pollutants, Book 10. Translated from Russian by R. S. Levine, U.S.S.R. Literature on Air Pollution and Related Occupational Diseases, Vol. 17, pp. 85-97, 1968.
CFSTI: PB 180522*

An investigation of the combined effect of phenol and acetone in low concentrations was made in an effort to determine hygienic standards for maximum allowable concentrations of these pollutants. The odor perception threshold concentration was determined using test persons whose odor perception was found to be the most sensitive. The reflex effect of an aceton-phenol mixture on eye sensitivity to light was investigated using the most sensitive test subjects and an adaptometer. The threshold concentration of acetone and phenol affecting energy brain potentials was established from desynchronization of the alpha-rhythm in generating an electrocortical conditioned reflex. Data from these 3 tests led to the conclusion that the combined effect of acetone and phenol in inhaled air is equal to the summary effect of the individual admixture components. A second phase of the study involved inhalation tests given to rats, in an effort to explain the resorptive action of low acetone and phenol concentrations in mixture. Chronic exposure produced shifts which caused disturbance of the normal chronaxy ratio of the muscle antagonists, reduction in blood cholinesterase activity and a decrease in the rate of coproporphyrin elimination by the urine. These final conclusions were made. (1) Biological effects of the phenol and acetone mixture will appear when the fractional summation of their individual allowable maximal will exceed the value of 1. (2) The maximum permissible concentration of a phenol-acetone mixture in atmospheric air should be set at the biologically inactive concentration level for single exposure where the fractional summation of the acetone and phenol individual single allowable maximal levels did not exceed 1. (3) The average-daily allowable phenol and acetone combination can be set at the maximum single-exposure level.

6086 APTIC NUMBER 15558

Princi, Frank
CHEMICAL TOXICITY - ACUTE AND CHRONIC. Preprint, Air Pollution Control Assoc., Pittsburgh, 18p., 1963. 12 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 56th, Detroit, June 10, 1963.)

The understanding of the effects of long and continued exposure to chemical agents and their absorption by body tissues depends on useful criteria of physiological response. Although many new explorations of physiological activity are now under way and never ones will be developed, there is already a sufficient amount of knowledge and understanding to protect and safeguard the public. However, both the 'old' and the 'new' must be applied thoughtfully and coherently. Seven criteria were proposed for the determination of the toxicity of chemical agents. A chemical is considered to have a toxic effect if an observable or measurable physiological deviation is produced in any organ or system; if the observed change can be duplicated from animal to animal, even though the dose-effect relationships may vary quantitatively; and if the stimulus has changed normal physiologic processes in such a way that a protective mechanism is impaired in its function of defense against other adverse stimuli. The effect must be either reversible or at least attenuated when the stimulus is removed. The effect must not occur in the absence of the stimulus or occur so infrequently as to indicate that the response is generalized and non-specific. The observations must be noted and must be reproducible by other investigators. The physiologic change must reduce the efficiency of an organ system or function and impair physiologic reserve in such a way as to interfere with the ability to resist or adapt to other normal stimuli in either a permanent or temporary fashion. These criteria were related specifically to biologic considerations and do not eliminate the need for standard concepts of chemical toxicology.

6087 APTIC NUMBER 18595

Reddy, R. S., P. S. Wostmann, and J. R. Pleasants
IRON, COPPER, AND MANGANESE IN GERMFREE AND CONVENTIONAL RATS. J. Nutr., 86(2):159-168, June 1965. 22 refs.

The effects of the microflora on the metabolism of iron, copper, and manganese were studied using germfree and conventional rats of both sexes. Hemoglobin and hematocrit values were similar in both groups, whereas plasma iron and copper levels were slightly but significantly lower in germfree than in conventional rats. The liver of the germfree rat stored more iron than that of the conventional rat, but the spleen, kidneys, and the total body of the germfree rat contained less iron than those of the conventional animal. The iron levels in females were higher than in males in both experimental groups. The relative proportions of ferritin and hemosiderin iron in the various organs of germfree and conventional rats were comparable. The levels of copper in these organs and in the total body followed the same pattern as the iron levels in germfree and in conventional rats. In contrast with the observations on iron and copper, the concentrations of manganese in the above mentioned organs and in the total body were similar in germfree and conventional rats. The results suggest a lower rate of iron and copper metabolism and a similar rate of manganese metabolism in germfree rats as compared with conventional rats.

6088 APTIC NUMBER 15899

Reiter, Reinhold
A PHYSICAL MODEL OF THE RESPIRATORY TRACT AS A SIMULATOR OF RETENTION. (Ein physikalisches Atemtraktmodell als Retentionssimulator). Text in German. In: Examples of Applied Research 1966/1967. Yearbook of the Fraunhofer Co., Stuttgart, Fraunhofer-Gesellschaft, (West Germany), 1968(?), p. 69-77.

A mechanical respiratory tract model was developed to determine the biological effect of aerosols. A known quantity of aerosol is drawn through four successive filters to simulate the dust retention and exhalation of particles in the 0.01 to 4 micron range. The metal screens which separate the filters measure the electric charge of the particles retained at each stage. Amounts of water vapor can be adjusted by a moisturizer, and after exposure, the filters can by physically or chemically analyzed. Practical application of the model in the vicinity of a metallurgical plant showed that a high fraction of atmospheric ferric oxide penetrated the alveolar ducts, while silicon dioxide and aluminum oxide aerosols were largely retained in the trachea and bronchi. Different results were obtained in the vicinity of a cement factory. In this case the SiO2 was primarily retained in the alveolar ducts, while the Fe2O3 and Al2O3 were retained in the bronchi. The chemical composition of the differently sized particles varied greatly. Measurements with radium aerosols showed retention of secondary products.

6089 APTIC NUMBER 18991

Reiter, R.
AN EXPERIMENTAL STUDY OF THE RETENTION OF RADIOACTIVE AEROSOL PARTICLES IN THE HUMAN RESPIRATORY TRACT. (Beitrag zur Frage nach der Retention radioaktiver Aerosolpartikel im Atemtrakt). Text in German. Atomkernenergie, 13(6):437-443, 1968. 28 refs.

The retention characteristics of natural radioactive aerosols were studied by observations on humans in a mine. The size distribution spectrum of the aerosol and the amount of radon decay products adsorbed on the particles were determined simultaneously. The results were compared with data from a four-stage retention simulator which was used to determine the distribution of aerosols with reference to the anatomy of the respiratory tract and the percentage of expired material. Agreement between the two sets of data was good. Aerosols with diameters less than 0.2 microneters have a conspicuously low retention rate. These results were checked with data from experiments on animal lungs where the percentage of total retention for particles with diameters ranging from 0.07 to 2.0 microneters was measured. (Author abstract modified)

6090 APTIC NUMBER 15905

Rose, Earl F.
CARBON MONOXIDE INTOXICATION AND POISONING. J. Iowa State Med. Soc., 58(10):909-917, Oct. 1968. 41 refs.

Carbon monoxide is the commonest air pollutant in the United States and, after alcohol, the commonest fatal poison in the country. Based on samples of hospital records throughout Iowa, it is estimated that over 680 patients were hospitalized for CO poisoning from 1963 to 1967. House fires produce CO concentrations up to 50,000 ppm, and a fire in a closed space is dangerous, not because it exhausts oxygen, but because it emits CO. CO poisoning occurs when the inhaled gas comes in contact with red blood cells in pulmonary capillaries and combines with their hemoglobin to form carboxyhemoglobin. The rate of this reaction is over 200 times more rapid than the rate of reaction of hemoglobin and oxygen. Tabulated correlations of atmospheric carbon monoxide, exposure duration, and carboxyhemoglobin show that atmospheric concentrations of 0.01% CO lead to a COHb saturation of 17%, no matter how long the exposure. Atmospheric concentrations of 0.1% CO lead to a COHb saturation of 50%, no matter how long the exposure. Physicians must be more aware of the danger of CO intoxication, and all carbon monoxide poisonings must be vigorously treated with 100% oxygen and, if possible, under hyperbaric conditions. The sequelae of acute CO intoxication must be acknowledged when neurologic complications follow apparently complete recovery from CO poisoning. Physicians examining alleged drunken drivers should consider the possibility of CO intoxication, and pathologists performing autopsies on automobile accident victims should test for COHb. Periodic inspections of motor vehicles should emphasize the detection of faulty mufflers and broken manifolds.

6091 APTIC NUMBER 13763

Royall, H. J.
THE HEALTH OF THE PUBLIC AND ASBESTOS USAGE. Royal Inst. Public Health Hyg. J. (London), 31(8-6):126-146, July-Dec. 1968. 49 refs.

The incidence of asbestos bodies in the lungs of various urban and rural populations throughout the world and the role of asbestos in the causation of tumors are discussed. Chrysotile, crocidolite, amosite, and anthophyllite are the main varieties of asbestos which are being produced at a rate of over 3,500,000 short tons per year. Asbestos bodies have been found in the lungs of populations throughout the world, ranging from 1% to 57% of the autopsied lungs of people of various occupations. Fifty-nine cases of non-occupational mesothelioma, probably due to domestic and environmental exposure to asbestos, are reviewed. The oils in asbestos, especially crocidolite, contain a polycyclic aromatic hydrocarbon, 3-4-benzopyrene, a well-known carcinogen, and crocidolite is considered to be very active in tumor causation. Tumors appear to form after a long latent period following exposure, thus making the asbestos exposure of young children especially hazardous.

6092 APTIC NUMBER 18897

Saruta, T., T. Ishinishi, T. Kodama, and T. Kunitake
EPIDEMIOLOGICAL STUDY OF THE EFFECTS OF AIR POLLUTION ON HUMAN HEALTH (1966). II. VARIATION OF THE INCIDENCE BY AGE GROUP AND CORRECTED INCIDENCE. (Taiki osen ga jintai ni oyobosu eikyo ni kansuru ekigaku taki chosa (1966). II. Rikarritsu no nenrei kaikyu betsu hendo oyobi tei sei rikanritsu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1): 101, April 1969.

This report is a study of the incidence of pollution-related disease according to age group. Bronchitis, asthma, and tuberculosis occur least frequently in children under 15 in Amagi, a garden city; incidence of tuberculosis is low for all age groups in this city. Inflammation of the nose and upper respiratory tract and eye irritation occur most frequently for all age groups in Yawata Ward of Kitakyushu City, an industrial area. Corrected incidence is obtained by converting the incidence of disease among various age groups in three cities into a value corresponding to the age groups of Yawata Ward in 1960. According to this corrected incidence, Fukuoka, a commercial city, shows the highest incidence of respiratory disease. Yawata Ward has the incidence of nose and throat disease and eye irritation due to foreign particles, and Amagi City has the highest rate of conjunctivitis. Amagi City has the lowest incidence of all forms of cancer, while the highest incidence in Yawata Ward for men and in Fukuoka City for women, especially with respect to lung cancer.

6093 APTIC NUMBER 18508

Saruta, M., M. Ishinishi, Y. Kodama, and F. Kunitake
EPIDEMIOLOGICAL STUDY OF THE EFFECT OF AIR POLLUTION ON HUMAN HEALTH (1966). I. SEASONAL VARIATION OF THE INCIDENCE. (Taiki osen ga ningen ni oyobosu eikyo ni kansuru ekigakuteki chosa (1966). I. Bikanritsu no kisetsu teki hendo). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1): 100, April 1969.

Using national health insurance program data, observations and comparisons were made on the incidence of various diseases related to air pollution according to month of the year, sex, and age group, in Yawata Ward of Kitakyushu City (an industrial area), in Fukuoka City (a commercial city), and in Amagi City (a garden city). Results are reported for the period April 1966 through March 1967. Diseases are classified as 'ordinary' or 'special' (respiratory, nose and throat, ophthalmic, and malignant tumors). Then, new cases of each disease are classified by month, sex, and age group. Seasonal variations in disease incidence are shown in graphs. The incidence of respiratory diseases is higher in winter, and the incidence of ophthalmic diseases is higher in summer. There was no typical seasonal variation for malignant tumors.

6094 APTIC NUMBER 15371

Schmidt, Otto-Peter
ETIOPATHOGENESIS OF THE BRONCHITIC SYNDROME. (Aetiopathogenese des bronchitischen Syndroms). Text in German. Ber. Sekt. Ynn. Med., Vol. 8:129-139, 1966. 29 refs.

The bronchitic syndrome may be caused by infections or it may develop in the wake of such diseases as pneumoconiosis and bronchiectasis. In many cases, the bronchitic syndrome develops as a consequence of irreversible damage of the cleaning mechanism ofthe lung. The enormous increase of this syndrome in the last few decades can be explained only by increased environmental influences. Each additional inhalation of inert dust irritates the bronchi and leads to inflammation with subsequent functional disturbances of the bronchi, the lungs, and the heart. In normal lungs not exposed to dust, the total dust content fluctuates between 0.8 and 1.5 g. Porcelain dust may settle in lungs in the range of 3 to 4 g, and even 20 g have been found. In exposure to coal dust, the total dust content may exceed 100 g. It is still difficult to assess just what role inert dust plays in the development of the bronchitic syndrome. Presently, it is assumed that they aggravate the disease. Cigarette smoke is considered to be most dangerous, followed by stack smoke and industrial dust. Exogenous factors assume great importance if there is already an increased flow resistance in the respiratory tract. Endogenous factors are equally important for the development of the disease. Favorable endogenous factors make it very unlikely that the syndrome will develop, even upon exposure to the most harmful pollutants.

6095 APTIC NUMBER 18822

Shabad, L. M.
BLASTOMOGENIC SUBSTANCES IN THE HUMAN ENVIRONMENT AND SOME MECHANISMS GOVERNING ORIGINATION OF CANCER. (O blastomogennykh veshchestvakh v okruzhayushchey cheloveka srede i nekotorykh mekhanizmakh vozniknoveniya raka). Text in Russian. Vestn. Akad. Med. Nauk SSSR, 24(6):3-13, 1968. 17 refs.

During a study of atmospheric pollution by carcinogenic hydrocarbons, aircraft engines were discovered as a source of contamination. Both carbon black and exhaust gases contained considerable amounts of benzopyrene(BP). The amounts of this substance detected in the ground of airfields decreased with distance away from the runways and landing strips. A study of soil contamination with BP showed it was capable of passing into plants and was liable to destruction by soil bacteria. Weeds and silt found downstream in a river flowing near a big city contained more BP than the upstream portion. Experiments showed it was possible to remove BP from the water. Certain medicinal preparations may be a source of carcinogenic hazards to man. The mechanism of action in carcinogenic substances is in its deposition in the tissues. Tests with transplacental blastomogenesis demonstrated that embryonic tissues display a high sensitivity to various carcinogenic substances and are apt to stimulate the growth of embryonic tissue organ cultures and produce tumors in them. (Author summary modified)

6096 APTIC NUMBER 15218

Shivpuri, D. N. and M. K. Agarwal
STUDIES ON THE ALLERGENIC FUNGAL SPORES OF THE DELHI, INDIA, METROPOLITAN AREA. CLINICAL ASPECTS. J. Allergy, 44(4):208-213, Oct. 1969. 13 refs.

A comprehensive investigation was done to evaluate the allergenic fungi in India. Results of 11,773 skin tests on 1079 patients with nasobronchial allergy and 1165 skin tests on 55 healthy persons with 29 antigens of fungi common in Delhi, India are

presented and compared. There were 5.9% markedly positive (2+ to 4+) skin reactions in patients but none in healthy control subjects, who showed only 5.1% 1+ reactions as compared with 8.9% in patients. If 1+ reactions are included, there were 14.7% positive skin reactions in the allergic patients. Bronchial tests were positive in about 66% and conjunctival tests were positive in 38% of the patients who had given positive skin reactions to the same antigens. The bronchial and conjunctival tests were negative in negative skin reactors, and conjunctival tests were also negative in 1+ skin reactors. About 29 fungi found in the environment of Delhi are arranged in order of allergenicity based on the frequency of markedly positive skin reactions produced by them. (Author abstract modified)

6097 APTIC NUMBER 18343

Spicer, William S., Jr., Patrick B. Storey, William Keith C. Morgan, H. David Kerr, and Natalie Elizabeth Standiford
VARIATION IN RESPIRATORY FUNCTION IN SELECTED PATIENTS AND ITS RELATION TO AIR POLLUTION. Preprint, Maryland Univ. School of Med., Baltimore, Div. for Pulmonary Diseases, 12p., (date ?).

As part of a long-term study of air pollution and respiratory disease, some preliminary results of a 21-week period of intensive observation of patients with chronic obstructive airway disease are discussed, comparing the mean physiological data with environmental factors. All patients were residents of a delineated area in Baltimore where more than 40% of the dwelling units lack central heating; the major Baltimore industrial complex lies to the south and southeast of the study area. Patient data was obtained by airway resistance tests, clinical examination, and laboratory tests of sputum collected from each patient. Environmental data was based on dirt sampling and weather information. Despite limitations in the data, it was observed that in general the patients became physiologically better or worse together to a greater extent than might be expected by chance. When this worsening was related to peaks or valleys of ambient atmospheric dirt, 50 of 67 patients at risk became worse during peaks, while only 13 of 67 patients at risk became worse during valleys.

6098 APTIC NUMBER 15386

Seltz, Harry A., Joseph G. Feldman, Edward P. Schlesinger, and William F. Mosher
AN EFFECT OF CONTINUED EXPOSURE TO AIR POLLUTION ON THE INCIDENCE OF CHRONIC CHILDHOOD ALLERGIC DISEASE. Preprint, American Public Health Assoc., Philadelphia, Pa., Epidemiology Section, 14p., 1969. 10 refs. (Presented at the American Public Health Assoc., 97th Annual Meeting, Philadelphia, 1969.)

The effect of air pollution on the morbidity of asthma and eczema in children under age 16 in Erie County, New York, was determined by surveying hospital records from 1951 through 1961. The cases were distributed by census tract of residence at the time of diagnosis and grouped according to the level of air pollution as measured by suspended particulates for each area; the 135 census tracts comprising the geographic area of the study were ranked on the basis of median income, education, and unemployment rate in 1960. Average annual incidence rates of 32.4 hospitalized asthma cases per 100,000 population at risk were found at the lowest air pollution level; 50.7 cases were found at the highest level. Average annual incidence rates of hospitalized eczema cases were only 2.9 per 100,000 population at the lowest air pollution level; 10.2 cases were found at the highest level. The incidence rates for asthma by social class and air pollution level increased consistently within each of the four social classes. A less regular pattern existed for eczema patients. Air pollution levels were associated with the incidence of boys under five hospitalized with asthma or eczema, increasing from 69.2 per 100,000 population in the lowest level to 117.5 in the highest level. The standard morbidity ratios for boys under five years of age increased from 45% at the lowest level to 153% at the highest level. The combined incidence rates for males diagnosed under five years of age showed a steady increase within each social class with an increase in air pollution. The finding that the incidence of asthma and eczema is similar for the younger age group supports the contention that most allergies have become established by the sixth year of life. Furthermore, air pollution affects the incidence of the more severe cases.

6099 APTIC NUMBER 18578

Swisher, Scott N. and Claude F. Reed
STUDIES OF METABOLISM AND MECHANISMS OF DESTRUCTION OF THE FORMED ELEMENTS OF THE BLOOD. (ANNUAL PROGRESS REPORT.) Rochester Univ., N. Y., Hematology Unit, Contract DA-49-007-MD-632, (5)p., June 8, 1964.
CFSTI, DDC: AD 601166

The turnover rate of erythrocyte phosphatidic acid phosphorus is very low. Incorporation of orthophosphate P32 into erythrocyte phosphatidic acid varies with the intracellular concentration of inorganic phosphorus and is independent of the presence or absence of ATP. Stimulation of active Na+ transport and the presence of ouabain do not affect incorporation of P32. The lipid composition of erythrocytes from patients with hereditary pherocytosis is normal. Hemoglobin free ghosts prepared from such a erythrocytes contain all the lipids present in the intact cell. The incorporation of P32 into ATP, glycolytic intermediaries and inorganic phosphorus in erythrocytes from such patients appears to be identical to that observed in normal red blood cells fro periods of up to six hours. The lipid composition of elliptocytes appears to be abnormal.

6100 APTIC NUMBER 15530

Symon, K.
HEALTH ASPECTS OF AIR POLLUTION. (Zdravotnicke aspekty znecisteni ovzdusi). Text in Czech. Ochrana Ovzdusi, 1(7):98-100, 1969.

Pollution of the lower atmosphere is discussed in terms of its physical, chemical, biological, and social influences.

In general, polluted air has a direct irritating or toxic effect on humans. In some forms, it weakens natural resistance. Pollutants also act indirectly by forming smoke and fog, thus lowering solar radiation and ultraviolet radiation. The result is a worsening of microclimatic conditions in experiments with plants and animals. To present objective proof under all circumstances is difficult. Knowledge of the effect of pollution on human health requires a knowledge of the ability of organisms to adapt to environmental changes. Social and technological progress are making it possible for the individual and society to influence the formation of the environment and to achieve an understanding of the interactions between an an organism and its environment.

6101 APTIC NUMBER 14913

Tateishi, Ryuhei, Yoshiyuki Morimura, and Shoji Hattori
GEOMETRIC CORRELATION OF AIR POLLUTION AND SMOKING ON THE HUMAN LUNG. (A PATHOLOGICAL STUDY). (Jintai ni oyobosu taikiosen to kitsuen no soiosayo. Byorigakuteki Kenkyu). Text in Japanese. Nippon Rinsho (Japan. Clin.), 25(10):2418-2426, Oct. 1967. 14 refs.

Carbon powder deposition and centrilobular emphysema were studied in 468 sample lungs from smokers and non-smokers who lived in cities and suburbs. Carbon desposition was dependent not only on the location of residence and age but also on smoking habits. The effect of the latter was more severe than that of the location of residence. Centrilobular emphysema was more frequently found among residents of polluted areas. Also, smokers had a greater chance of acquiring centrilobular emphysema and of having carbon deposition as well. When the degree of carbon deposition was the same, smokers had much higher incidence of severe centrilobular emphysema than non-smokers. It was concluded that smoking damages the defense mechanism of the lung against carbon deposition and centrilobular emphysema.

6102 APTIC NUMBER 15211

Terry, R. A., D. G. Warden, and A. M. Mayyasi
EFFECTS OF NEGATIVE AIR IONS, NOISE, SEX AND AGE ON MAZE LEARNING IN RATS. Intern. J. Biometeorol., 13(1):39-49, 1969. 8 refs.

The effect of negative air ionization, noise, age, and sex on maze learning in rats was investigated; 280 rats were tested. Equal numbers of males and females were divided into two age groups: the young group was 21-30 days old and the adult group was 90-100 days old. The age of the rats was held constant during the five weeks of the experiment by weekly supply from the breeding colony. They were exposed to two levels of noise; 30 and 90 decibels, and three levels of negative air ions: zero concentration, 7,000,000, and 70,000,000 ions/cc. Time and error scores of the rats running in a modified Lashley left-right maze with an escape-from-water motive served as criteria. A randomized complete blocks design (2 times 3 times 2 times 2 times 10) with replications was selected for treatment by analysis of variance. The results indicated that males show significantly lower error score in negatively ionized air and females swim significantly faster than males under all investigated conditions with no apparent effect of noise or ions on their performance.

6103 APTIC NUMBER 14821

Tovama, Toshio
AIR POLLUTION AND ITS HEALTH ASPECT IN TOKYO AREAS. Asian Med. J., 11(12):5-15, Dec. 1968. 3 refs.

Air pollution is discussed as the largest public health problem in the Tokyo area. Within this broad region, the Kawasaki-Yokohama area shows a general heavy industrial type of pollution; the Chiba area, petroleum industry pollution; and Tokyo, pollution from mixed sources including chemical industries, central heating systems, and automobile exhaust. In the metropolitan area, eight modern pollution-measuring stations form the basis of a monitoring network connected with the Institute of Public Hazards. Various studies made in 1959-61 of pulmonary ventilatory function of schoolchildren in Tokyo and nearby areas indicated by a reduced expiratory flow rate, some temporary responses to atmospheric irritants. In about 1963, when a smoke abatement law was passed, the nature of air pollution began to change from localized pollution, caused by particulates, to wide-ranging pollution from such gases as sulfur dioxide, so that localized geographic differences of pollution effects are now almost impossible to prove. Therefore, studies of mortality, morbidity, and prevalence of pulmonary symptoms are now of greater epidemiological importance. Combined studies of comparable U. S. and Japanese occupational groups are being conducted, using questionnaires and medical tests to investigate respiratory symptoms and pulmonary function. Some preliminary data indicate a higher prevalence of such symptoms in the U. S. (and England) than in Japan, but it is thought that this may be due to the time difference in the history of industrialization. The mortality rate from lung cancer has been increasing recently in Japan and may be related to increasing numbers of cigarette smokers. The rapidly increasing number of car registrations in Tokyo is considered a major source of new air pollution.

6104 APTIC NUMBER 15666

Traczyk, Kazimierz
SURFACE TENSION AND SURFACTANT ANTI-ATELECTASIS FACTOR IN THE LUNG TISSUE. (A REVIEW). (Napiecie powierzchniowe i czynnik przeciwniedodmowy w tkance plucnej (Praca poglądowa)). Text in Polish. Gruzlica Choroby Pluc, 37(6):565-573, 1969. 30 refs.

The normal functioning of the lungs is reviewed with respect to surface tension of the smooth soft layers of the lung and factors disturbing that tension. The following areas are discussed: surface tension of the alveoli and surfactant anti-atelectasis factor, particularly as it relates to the general characteristics and action; chemical composition; origin; measurement technique; and significance of anti-atelectasis factor in lung pathology.

6105 APTIC NUMBER 15851

Ueda, K.
STUDIES ON THE HARMFUL EFFECTS OF MERCURY WITH SPECIAL REFERENCE TO MERCURY INTOXICATION AMONG DENTAL TECHNICIANS. (Suigin no dokusei ni kansuru kenkyu: Tokumi shikairyo ni okeru suigin-chudoku). Text in Japanese. Shika Gakuho (Monthly Record Dental Sci., Pract., Miscellany), 68(6):941-951, 1968. 22 refs.

Dentists and dental technicians are exposed to the dangers of mercury inhalation and absorption through the skin. The maximum tolerable concentration of mercury vapor in the air is 0.1 mg/cu m. The room where mercury amalgam for fillings is compounded can provide a very hazardous environment if ventilation is inadequate, since mercury under such conditions can reach a level of 19 mg/cu m. A mercury vapor meter which directly measures ambient vapor concentrations by means of a mercury lamp at a wavelength of 253.7 millimicrons is a convenient instrument with a sensitivity of 0.01 mg/cu m. The atmospheric concentration of mercury vapor is directly proportional to the amount of mercury excreted in the urine. The day after receiving a filling, the patient, as well as the dental technicians, show twice to ten times, respectively, the normal amount of mercury excretion. In recent years, mercury vapor meters used in dental offices have helped to maintain a normal level of urinary mercury excretion in dental workers. Allergic reactions to mercury, occurrence of mercury in foods, symptoms of acute and chronic mercury intoxication, and treatment are also discussed.

6106 APTIC NUMBER 15555

Waldbott, G. L. and V. A. Cecilioni
'KEIGHBORHOOD' FLUOROSIS. Fluoride Quarterly, J. Intern. Soc. Fluoride Res., 2(4):206-213, Oct. 1969. 9 refs.

Data obtained from medical examinations or medical histories established the presence of the nonskeletal phase of fluorosis 32 individuals living in areas near fertilizer factories and an iron foundry and where fluoride damage to vegetation, livestock, and to materials had been determined. The symptomology of the disease is identical with that of the nonskeletal phase of fluorosis recorded by others in industrial fluorosis, neighborhood fluorosis, hydrofluorosis, and fluoride intoxication from long-term administration of fluoride tablets. The musculoskeletal, gastrointestinal, and respiratory systems were principally involved. Fluoride assays of hay, flydust, human tissue, and urine are presented. Ten individuals exhibited the skin lesions designated as Chozzola Maculae which were recently described in population exposed to fluoride emanations near aluminum factories in Italy. It was concluded that fluoride emissions from the factories were the source of the illness. (Author summary modified)

6107 APTIC NUMBER 15915

Weng Tzong-Tuey, Elizabeth A. Weatherby, John Goold, and Henry Levison
RELATIVE SENSITIVITY OF METHODS FOR MEASURING AIRWAY RESISTANCE IN ASTHMATIC CHILDREN. Ann. Allergy, vol. 27:565-570, Nov. 1969. 20 refs.

The degree of correlation among three methods of measuring resistance to airflow in bronchial airways was studied in 18 asthmatic boys and 10 asthmatic girls 6-14 years of age. The methods evaluated were indirect measurement of airway resistance by body plethysmography, maximum breathing capacity and indirect measurement of flow rate by spirometery, and expiratory peak flow rate by a peak flow meter. The relative sensitivity of the methods was assessed before and after treating the children with a bronchodilating agent. In all instances, except maximal inspiratory flow rate, correlation coefficients among tests improved after the bronchodilator treatment. Airway conductance was found to be the most sensitive index of changes in airway resistance followed by maximal midexpiratory flow and other spirometric measurements. The significant correlation between peak expiratory flow and one-second forced expiratory volume is a good indication of the reliability of the peak expiratory flow measurement, since maximal midexpiratory value is determined by the physical properties of the lower airways and not dependent on the effort. The peak expiratory flow method is perhaps the best office or bedside test for day-to-day or hour-to-hour assessment of a patient's response to bronchodilator therapy.

6108 APTIC NUMBER 15732

Won, William D. and Harold Ross
REACTION OF AIRBORNE RHIZOBIUM MELILOTI TO SOME ENVIRONMENTAL FACTORS. Appl. Microbiol., 18(4):555-557, Oct. 1969. 9 refs.

The laboratory findings on the behavior of airborne R. meliloti (1027S) in relation to relative humidity (RH), ultraviolet light radiation, and certain common gaseous atmospheric pollutants were reported. Survival of R. meliloti in aerosols at 20 C was maximal at high RH and minimal at low RH. Relatively high concentrations of nitrogen dioxide, sulfur dioxide, or formaldehyde were needed to significantly reduce viability of R. meliloti in aerosols at 50% RH. Except for the reduction in activity of formaldehyde by SO2, there was no additive or antagonistic effect of mixing pollutants. High environmental RH enhanced bactericidal activity of NO2 and SO2. High RH minimized and low RH accentuated the biological effect of ultraviolet light of 300 to 400 nm wavelength. (Author abstract modified)

6109 APTIC NUMBER 15380

Yaguchi, Satoshi
INFLUENCE OF AIR POLLUTION ON THE VENTILATORY FUNCTION FOR PATIENTS WITH PULMONARY TUBERCULOSIS. (Taiki osen no hai-kekkaku-kanja no kanki-kino ni oyobosu eikyo ni kansuru kenkyu). Text in Japanese. Iryo (Tokyo) (Therapeutics), 23(1):92-96, Jan. 1969. 18 refs.

Thirteen patients with pulmonary tuberculosis were studied with respect to symptoms (cough, sputum, shortness of breath), chest

X-ray findings, ventilatory function, and complications. The patients were classified in three groups, depending upon symptoms and treatment. Tests of ventilatory function included vital capacity (VC), percent forced expiratory volume (FEV), magnetomotive force (?) (MMF), and MBC. The degree of air pollution was estimated by measurements of suspended particulates and sulfur dioxide concentration during the six month research period from July 1966 to March 1967. During this time, the air was especially polluted between November and February; suspended particulates were 9.5-11.5%, and SO2 was 2.6-8.5 ppm. Results showed that most of the patients had cough and sputum in addition to frequent common cold infections. Obstructive ventilatory disturbance was associated with reduced FEV and MMF. No definite variations in VC or MBC were found, and there was no demonstrable correlation between degree of air pollution and abnormalities as seen in chest X-rays.

6110 APTIC NUMBER 14892

Yamaga, S., K. Ohsori, F. Tanaka, and H. Wakamura
EFFECTS OF INHALATION OF LEADED GASOLINE. (Kaen gasoline kyuniyu no eikyo ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):148, April 1969.

Since leaded gasolines have been increasingly used as automobiles multiply, the examination of their effects on human health has become necessary. Examination of lead content of the urine of 16 gas station attendants and nine automobile drivers did not show the influence of lead inhalation. The lead content of blood, urine, and organs was studied in six rabbits who inhaled 500 ppm leaded gasoline for 3 hrs/day, five days a week, for 92 to 220 days. Lead in the blood increased gradually, but lead in the urine did not vary much. General quality of blood was normal, except that some samples were anemic. Accumulation of lead in the liver and kidneys was observed in all cases.

6111 APTIC NUMBER 15680

Yokoyama, Fiji
A COMPARISON OF THE EFFECTS OF SO2, NO2, AND O3 ON THE PULMONARY VENTILATION OF GUINEA PIGS. (SO2 to NO2 oyobi O3 no kankino moyoboso eikyo no hikaku-monomotto no okeru bakurojikken). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 11(11):563-568, Nov. 20, 1969. 21 refs.

Ventilatory functions of guinea pigs were quantitatively measured before, during, and after 2-hour exposure to SO2, NO2, and O3. The gases caused an increase in the flow resistance of the animals, although the degree of change varied for the three gases. A significant difference was observed in the direction of change in the respiratory rate. Sulfur dioxide caused a decrease in the respiratory rate while NO2 and O3 caused a decrease. The tidal volume changed in a direction opposite to the change in the respiratory rate. The changes in the ventilation function of the respiratory system were attributed to differences in lung area between exposures. (Author abstract modified)

6112 APTIC NUMBER 13968

Yokoyama, Fiji
VARIATIONS OF VENTILATORY DYNAMICS IN EXPERIMENTAL EXPOSURE TO SO2 AND NO2. (SO2 oyobi NO2 jikken-bakuro-ji no kanki-rikigaku-chi no henka). Text in Japanese. Arerugi Nippon Zasshi (Jap. J. Allergy), 16(10):56-60, Oct. 1967. 17 refs.

Six healthy adults aged 20 to 36 were experimentally exposed to SO2 gas, and five healthy adults aged 18 to 37 were exposed to NO2 gas. Pulmonary flow resistance, pulmonary compliance, FRC, and respiratory rate were measured. Concentrations of SO2 during the experiment were 36 to 40 ppm; those of NO2 were 6 to 17 ppm. Experimental exposure to these two gases and similar analyses were made in anesthetized dogs and guinea pigs. Flow resistances of the lungs and thorax because of bronchoconstriction were commonly increased by both SO2 and NO2 in three experiments. The following response to these gases, however, differed. Increase of pulmonary flow resistance to SO2 was inhibited by the subcutaneous administration of 0.7 mg of atropine sulfate, but no inhibition by atropine was observed with NO2. Respiratory rate was increased by NO2 and decreased by SO2 in an experiment with guinea pigs. Variation in pulmonary compliance was more marked with NO2 than with SO2. The SO2 was found to stimulate mainly the upper respiratory tract (nose, throat, and upper trachea) because it is water-soluble and because more than 95% of it is absorbed within the upper respiratory tract. The NO2 was found to stimulate mainly the peripheral portion of the lung because it does not dissolve easily in water and thus is easily brought to the peripheral portion of the respiratory tracts. Nitrogen dioxide was found to have an oxidizing action and to damage the pulmonary mucosae more markedly than the reductive action of SO2.

6113 APTIC NUMBER 14880

Yoshida, T., K. Motomiya, M. Adachi, K. Ito, M. Kubo, H. Kasuga, K. Hida, and J. Ooeda
STUDIES ON BRONCHIAL ASTHMA AMONG PRIMARY SCHOOL CHILDREN IN CITY AND IN SHIZUOKA PREFECTURE. 1. EPIDEMIOLOGICAL STUDIES. (Shizuoka-ken P-shi shogakko jido no kikanshi zensoku ni kansuru kenkyu. 1. Dkigaku teki kosatsu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):98, April 1969.

A survey was conducted of the absentee rate at six primary schools (three in polluted areas and three in non-polluted areas) from Sept. 1966 to March 1967. Both percentage of absentee days and number of children absent were higher at the control schools, but the rate of respiratory tract disease among absentee children was higher at the schools in polluted areas. From April 1967 to March 1968, both percentages of absentee days and number of children absent were higher at the schools in polluted areas. The polluted area schools had a higher level (1.19%) than the control schools (0.52%) of the children suffering from asthma. Furthermore, average frequency of absence per child was higher at the former (3.13 times) than at the latter (1.58 times). On close medical examination of children

with suspected asthma, the percentage of children diagnosed as having bronchial asthma was 0.65% for control schools and 1.21% for the others. Furthermore, 50-80% of the suspected cases of asthma determined by questionnaires can be diagnosed clinically as asthma.

6114 APTIC NUMBER 18493

Yoshida, M., K. Motomiya, M. Adachi, K. Ito, M. Kubo, et al.
STUDIES ON BRONCHIAL ASTHMA AMONG PRIMARY SCHOOL CHILDREN IN 'A' CITY IN CHIBA PREFECTURE. (Chiba-ken A-shi shogakko jido no kikanshi zensoku ni kansuru kenkyu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):96, April 1969.

Close medical examination was conducted of children diagnosed as having bronchial asthma and attending primary schools in the polluted and non-polluted areas. More children from polluted area schools had asthma than children from control schools, but the differences were not statistically significant. A comparison of symptoms shown by nine children whose asthma started in city 'A' with those of four children from other areas did not yield any meaningful conclusions. No significant information was derived from case histories of allergy among the children or their families, age at which the disease began, or seasonal variations in severity of the disease. A relationship between the degree of pollution and seasonal incidence of asthma was not found.

6115 APTIC NUMBER 18499

Yoshida, M., K. Motomiya, M. Adachi, K. Ito, M. Kubo, H. Kasuga, K. Hida, and J. Goeda
STUDIES ON BRONCHIAL ASTHMA AMONG PRIMARY SCHOOL CHILDREN IN 'B' CITY IN SHIZUOKA PREFECTURE. 2. CLINICAL STUDIES. (Shizuoka-ken B-shi shogakko jido no kikanshi zensoku ni kansuru kenkyu. 2. Rin sho teki kosatsu). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):95, April 1969.

A survey was conducted among 63 children diagnosed as having asthma. The children came from one of six primary schools; three schools were located in polluted areas and three in non-polluted areas. The ratio of boys to girls was 2:1 for the control schools and 1:1 for the polluted area schools. The families of 68.2% of the children also had allergies. A similar percentage of children had histories of allergic disease. There was a trend at schools in polluted areas for children to acquire this allergy at a lower age. Children suffering from asthma throughout the year comprised 18.2% for the control schools and 34.2% for the polluted area schools. Positive reactions of children for ragweed, antigens, and house dust was greater in polluted area schools.

6116 APTIC NUMBER 15893

Yoshii, Masakiyo, Jun Monovama, Hidehiko Oshma, Hiroshi Yamagiva, and Susumu Takeda
CHRONIC PHARYNGITIS IN AIR-POLLUTED DISTRICTS OF YOKKAICHI IN JAPAN. Mie Med. J., 19(1):17-23, May 1969. 4 refs.

The clinical, epidemiological, and histopathological examinations on the specific type of pharyngitis found in school children and young adults residing in industrially polluted districts of Yokkaichi were described. Data was based on 5331 cases of outpatients. The clinical features of the disease are characterized by the following symptoms in the pharyngeal mucosa: a diffusely dull white color, several reddish swollen lymph follicles, and extended veins with interrupted blood flow seen as fragments. The biopsy specimens showed epithelial proliferation in the Malpighian layer and granulomatous change with a scaric pattern in the upper layer of the lamina propria. The epidemiological survey showed that the incidence of chronic and specific pharyngitis was 4.18% and 2.15% respectively in heavily or moderately polluted districts, and 3.19% and 0% in non-polluted districts. The results suggest that this disease is due to a chronic inflammation in the upper layer of the pharyngeal mucosa induced by the respiration of polluted air over a long period.

6117 APTIC NUMBER 18829

Zolotukhin, A. N.
COMBINED INFLUENCE OF SMALL CONCENTRATIONS OF CARBON MONOXIDE AND HYPOXIA ON THE VISUAL ANALYZER. (O kombinirovannom devstvii malykh kontsentratsiy okisi ugleroda i gipoksii na zritel'nyy analizator). Text in Russian. Voenno-Med. Zh., vol. 8:50-68, April 1968.

Studies were made with 10 healthy nonsmoking males 20-28 years of age. Effects of carbon monoxide concentrations of 0.03 and 0.01 mg/l at ground level and at 3500 m altitude on visual acuity were tested. Carboxyhemoglobin levels were measured and tachistoscope tests were made; experimental data are tabulated. It is concluded that on the basis of 3-hour exposure, the maximum permissible dose of CO in aircraft cabins should be set at 0.01 mg/l.

6118 APTIC NUMBER 15899

Baer, Charles H.
REPORT ON A SHORT-TERM SURVEY OF THE EFFECTS OF AIR POLLUTION IN SELECTED AREAS OF THE KANAWHA AND OHIO VALLEYS OF WEST VIRGINIA. West Virginia Univ., Morgantown, Dept. of Biology, Contract PH 27-65-12, 46p., Dec. 1968.

A short term study of apparent air-pollution effects on plants in the principal industrial centers of West Virginia was undertaken to test standard ecological methods for a long-term ecological study of the area. Phytosociological methods for detecting the effects of air pollution were less than promising, the complex nature of the mixed hardwood or mixed mesophytic forests making the definition of a normal, undisturbed type extremely difficult. The standard deviations of such plant communities would probably exceed all but the more severe impacts of air pollution. Edaphic, topographic, and successional forces change in a matter of a few yards inducing a maze of association segregates whose composition blends into that of the contiguous communities and defies quantitative analysis. A more fruitful approach to detecting community alteration may be based on numerical expression of interspecific relationships by correlation coefficients of pairs and groups of species. Only groupings of dominant species which normally contain at least one susceptible species need be tabulated. Aerial survey methods of detecting and recording air pollution patterns and damage should be put to greater use, since location of the sites where significant groups of forest species are accessible can best be accomplished by aerial reconnaissance. Other methods of detection seem more applicable to the problem in industrial sections of the Kanawha and Ohio Valleys: These include immediate inspection for foliar symptoms following reported exposure to atmospheric pollutants, plant indicator methods employing systematically distributed plots, growth and reproduction studies of naturally seeded species suspected of being susceptible to air pollutants, and distribution patterns showing susceptibility to known air pollutants. This survey indicated that a long-term series of studies concerning the effects of air pollution on the natural vegetation is feasible, and potentially productive and that damage to vegetation by fires has been greater than that caused by air pollution.

6119 APTIC NUMBER 14817

Boertitz, Siegfried and Michael Vogl
PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO SMOKE DAMAGE RESEARCH. 9. PHYSIOLOGICAL INVESTIGATIONS OF RESISTANCE DIFFERENCES OF PINUS SILVESTRIS. (Physiologische und biochemische Beitraege zur Rauchschadenforschung. 9. Physiologische Untersuchungen zur individuellen Rauchhaerte von Pinus silvestris). Text in German. Arch. Forstw., 18(1):55-60, 1969.

To separate the effects of prior exposure to sulfur dioxide and of higher sensitivity to SO2 in evaluating results of SO2 exposure tests, measurements of intensity of assimilation and transpiration and of smoke resistance of plants should be carried out independently on specimens grown in smoke-free environments. Accordingly, twigs cut from 16 clones of 12-year old pine tree grafts were subjected to shock-gassing by a previously described method and ranked according to their smoke resistance. The most and the least resistant clones were selected for subsequent tests in (1) SO2-free air and (2) air containing 0.4, 1.5, or 3.0 ppm of SO2. In (1), May shoots cut from either kind of clone were trimmed under water and kept standing in water for two or three days, after which their gas exchange was measured in the laboratory with coupled infrared absorption spectrographs. In (2), individual intact twigs of either kind of clone were gassed with SO2-containing air in situ, and their CO2 assimilation was measured by a previously described method. In (1), the net assimilation intensity of either kind of clone showed no significant differences, that of less resistant clones tending to be higher while exhibiting wider individual variations. In (2), the depression of net assimilation due to shock-gassing sets in sooner in the less resistant clones; also, at higher SO2 content, the depression is more intense and the recovery is slower than in the more resistant clones.

6120 APTIC NUMBER 14968

Daines, Robert H., Eileen Brennan, and Ida Leone
AIR POLLUTANTS AND PLANT RESPONSE. J. Forestry, 65(6):381-388, June 1967. 15 refs.

The effects of a number of acid gases and photochemically-produced pollutants on plants are described. A great variation in susceptibility to damage by such gases as fluorides and SO2 exist both among plant species and within a single species. Injury from these gases occurs primarily to younger leaves, with little or no damage shown by old leaves. Symptoms usually consist of marginal and tip necrosis with accompanying discoloration of the affected areas. Limited studies with chlorine suggest that it is less phytotoxic than hydrofluoric acid, requiring about 0.1 ppm to injure the more sensitive plants. Among the photochemically-produced pollutants, ozone has been known for many years to be toxic to a wide variety of plant species; ozone toxicity symptoms appear as flecks, stipple, streaks, spots, and tip necrosis. Injury appears on mature leaves, with the oldest leaves of young plants and middle-aged leaves of old plants being most susceptible. Peroxyacetylnitrate (PAN) and its analogues are highly phytotoxic, producing symptoms called 'silver leaf' and 'leaf banding' in California, the northeastern U. S., and other urbanized areas. Like ozone, these compounds are believed to cause severe annual economic losses in crop damage. Investigations of damage caused by other photochemical pollutants, namely ozonated hydrocarbons, bisulfite reaction products, and nitrogen dioxide, are briefly summarized, and the major sources of all the pollutants discussed are noted.

6121 APTIC NUMBER 15286

Dass, H. C. and G. M. Weaver
MODIFICATION OF OZONE DAMAGE TO PHASEOLUS VULGARIS BY ANTIOXIDANTS, THIOLS AND SULPHYDRYL REAGENTS. Can. J. Plant Sci. (Ottawa), vol. 48:569-578, 1968. 13 refs.

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The mechanism of the 'bronzing' effect of ozone on white beans (Phaseolus vulgaris), and the degree of protection, if any, offered by various compounds, were investigated. Representative cultivars of white bean were treated with selected antioxidants, thiol compounds, and sulfhydryl reagents and then exposed to ozone under laboratory conditions. Severity of the bronzing disorder was influenced by such treatments, as was the activity of peroxidase and lactic dehydrogenase enzymes. Dust applications of the antioxidants, ascorbic acid and nickel-N-dibutyldithiocarbamate markedly reduced ozone injury, the latter compound being the most effective. Decreased ozone sensitivity was also noted following treatment of a susceptible and a tolerant cultivar with the thiols cysteine hydrochloride and glutathione. The severity of bronzing was increased over that of the control plants by the application of the sulfhydryl reagents parachloromercuribenzoate and N-ethyl maleimide. Necrotic stipple of the upper surface of the lamina, a symptom associated with the bronzing disorder, was induced following treatment with the sulfhydryl reagents without exposure to ozone. Ozone fumigation increased peroxidase activity and decreased lactic dehydrogenase activity. Similar effects were observed following treatment with parachloromercuribenzoate. Neither enzyme showed response to the application of cysteine hydrochloride. The role of protein sulfhydryls is discussed in relation to ozone damage and the bronzing disorder. (Author abstract modified)

6122 APTIC NUMBER 14826

Feder, William A. and Franklin J. Campbell
INFLUENCE OF LOW LEVELS OF OZONE ON FLOWERING OF CARNATIONS.
Phytopathology, vol. 58:1038-1039, July 1968. 3 refs.

The effects of the exposure of carnations to low levels of ozone for a prolonged period were investigated in a controlled study. Carnations grown in the presence of ozone at levels below which visible injury usually appears were damaged: an average level of 0.075 ppm for about 10 days depressed bud formation in White Sim carnations if the plants were exposed to the ozone at the time of bud initiation. Exposure periods of eight weeks at these ozone levels were required before tip burn symptoms appeared, whereas such damage was evident only 48 hr after the plants were exposed to oxidant levels of 0.12-0.15 ppm for an 8-hr period. No tip burn occurred in plants grown in filtered air. In addition, plants in the ozone-charged air were bushier and shorter than the control group.

6123 APTIC NUMBER 15892

Feder, William A., Franklin J. Campbell, and Norman W. Butterfield
TIP BURN, AN OXIDANT INDUCED RESPONSE OF CARNATIONS. Plant Disease Reptr., 51(9):793, Sept. 1967.

Leaf tip burn was observed on greenhouse carnations in Massachusetts and occurred only on the younger leaf tips of young plants. The tips were killed and turned a straw brown color. Symptoms extended from a few mm to 2-3 cm back from the tips and were set off from the rest of the leaf by a sharp margin; tissue below the burned tip was healthy. Damage was restricted to the affected tips and persisted while the rest of the plant continued to grow normally. Microscopic examination of the dead leaf tips revealed no pathogens. The incidence of carnation tip burn occurred within 24-48 hrs after a 3-day period during which a high level of oxidant was recorded in the Waltham, Mass. area. Levels during this period exceeded 10 pphm for 4 hrs and averaged over 6 pphm for the 72-hr period. Carnations growing in air pollution study chambers in charcoal-filtered air were free of tip burn, whereas those grown in chambers receiving unfiltered air had a high incidence of tip burn. The evidence points to some airborne toxicant as the apparent cause of tip burn. The high oxidant level recorded just before the damage seemed to implicate ozone as one possible cause of carnation tip burn. However, the damage may actually be caused by a mixture of toxicants including ozone.

6124 APTIC NUMBER 13717

Gilbert, O. L.
BRYOPHYTES AS INDICATORS OF AIR POLLUTION IN THE TYNE VALLEY.
New Phytol., 67:15-30, 1968. 27 refs.

Detailed mapping and recording have shown that many of the commonest bryophytes in Northumberland are totally absent from a large part of the lower Tyne Valley. The affected area is centered on the coalfield where scattered colliery towns, burning pit heaps, and the huge conurbation of Newcastle upon Tyne lie. Emphasis is laid on sulfur dioxide pollution being responsible. Two anomalous situations where sensitive species are found growing well inside their normal limit were investigated. It appears that shelter has a greatly modifying effect in reducing SO2 (but not smoke) levels and that a high pH influences the degree of ionization and rate of oxidation of SO3(2-) so as to favor survival. Protonemata appear to be more sensitive than mature gametophytes. Most bryophytes cannot exist when the average winter concentration of SO2 exceeds 50 microgram/cu m or 0.01 ppm. But they are not affected by solar energy losses caused by smoke pollution. (Author abstract modified)

6125 APTIC NUMBER 14713

Gillette, Donald G.
AIR POLLUTION DAMAGE TO COMMERCIAL VEGETATION. Preprint, Virginia Polytechnic Inst., Blacksburg, Water Resources Research Center, 11p., April 1969. 8 refs. (Presented at the Seminar on the Economics of Air and Water Pollution, Blacksburg, Va., April 28-30, 1969.)

Air pollution injury to plants is a serious agricultural problem in the United States. The variety and amounts of pollutants emitted into the atmosphere have increased. The principal pollutants causing vegetation damage are fluorides, ozone, sulfur dioxide, peroxyacylnitrates, and ethylene. Other air pollutants that occasionally cause plant damage are chlorides, chlorine, hydrogen sulfide, ammonia, various types

of hydrocarbons, sulfuric acid aerosols, sulfates, and sulfites. Many of these so-called minor pollutants are emitted from specific industrial operations. The pollutants responsible for most of the air pollution damage to vegetation vary considerably from area to area. Damage includes growth suppression, hidden injury effects, genetic differences, necrotic lesions, chlorosis, bronzing, and glazing. Recent estimates of the annual damage caused by pollutants to commercial crops in this country range from $250 to $500 million (1969). Estimates of crop damage from air pollutants are based primarily on crude estimating procedures. In an effort to attain greater competency in estimating this damage, training programs to assist county agricultural agents to identify air pollution injury to vegetation are being developed. A national survey to assess vegetative damage from air pollution was initiated. In addition, rapid survey techniques, including aerial photography and remote sensing devices, are being employed to detect vegetative damage. The ultimate objective of all this effort is to improve the methodology and reliability of estimating economic losses to agriculture from air pollutants.

6126 APTIC NUMBER 15538

Guderian, R.
REACTIONS OF PLANT COMMUNITIES IN THE FIELD CULTIVATION OF FODDER TO SO2. (Reaktionen von Pflanzengemeinschaften des Feldfutterbaues auf Schwefeldioxideinwirkungen). Text in German. Schriftenreihe Landesanstalt Immissions-und Bodennutzungsschutz Landes Nordrhein-Westfalen (Essen), no. 8:80-100, 1967. 7 refs.

Sulfur dioxide exposure experiments were performed in small plastic greenhouses where various types of fodder plants (clover, grass, rye, etc.) were grown either in pots or in the soil. Various SO2 concentrations and exposure times were selected. In the first experiment, clover (Trifolium pratense) and grass (Lolium multiflorum) were exposed for 9 hours to SO2 concentrations of 1 mg, 2 mg, and 5 mg/cu m air. While 1 mg SO2 had no effect on the plants, 2 mg clearly retarded growth of the clover. The grass showed a reduced growth rate only at 5 mg, whereas the clover growth rate was already down to 37% that of the control. This selective effect of SO2 could be confirmed by other experiments with Vicia villosa Roth, Trifolium incarnatum L., and Lolium multiflorum. The first two plants experienced extremely retarded growth, while the last grew satisfactorily. The shift in the composition of plant communities becomes more pronounced at higher SO2 concentrations. Resistance of the plants to air pollutants varies with their developmental stage. Exposure to SO2 of Vicia villosa Roth. and Avena sativa L., which were both in an early developmental stage, showed that the latter was damaged much more in the eight-leaf stage than in the 3-leaf stage. The Vicia villosa growth rate was greatly reduced, while oats produced more chlorophyll. A study of the yield of clover and Lolium multiflorum grown together and separately showed that the former had a lower yield in both cases, and the latter had a higher growth rate in the mixed bed than when grown alone.

6127 APTIC NUMBER 14710

Hadduk, J.
EMISSIONS AND OCCURRENCE OF NECROTIC SPOTS ON THE PLANT LUZULA ALBIDA (HOPPE.) DC. (Emisie a vyskyt nekrotickych skvrn na rastline Luzula albida (Hoffe.) DC). Text in Czech. Ochrana Ovzdusi, no. 3:82-85, 1969. 5 refs.

Because of its increased surface area in comparison to the portion of the earth's surface it occupies, vegetation creates conditions for catching a great amount of emissions. The ratio between the amount of emissions trapped and earth surface is a significant indicator of tree damage and secondary air pollution. Herbst found that entrapment of emission particles is governed by space orientation of leaves on a plant, by shagginess, by the number of individual plants, and by the size of individual emission particles. Chvapil concluded that the ability of lindens, birches, and acacias to entrap particles is related to leaf smoothness and the space orientation of leaves. The present investigation shows that the ability of Lazula albida (Hoffe.) DC to catch emissions from rainfall is the result of the shape of leaves and their orientation on the plant. Emissions settle on the leaves of this plant, providing a mask for necrotic markings caused by toxic soluble substances. As indicated by microscopic analysis, these substances originate in products of industrial emissions. The amount of sediment and the size of necrotic spots is influenced by peculiarities of individual plants and plant ecology, as well as by emission concentration. A rough picture of pollution of the lower atmosphere can be gained from a study of this plant, which predominates in European woods.

6128 APTIC NUMBER 14678

Hadjuk, Jurai
REACTION OF SOME RELATIVELY RESISTANT PLANTS TO SUDDEN INCREASE IN THE CONCENTRATION OF FLUORINE EXHALATIONS. (Reakcia niektorych relativne rezistentnych rastlin na narazove zvysenie koncentracie fluorovych exhalacnych splodin v okoli hlinikarne). Text in Slovakian. Biologia, 21(6):421-427, 1966. 19 refs.

Since 1961, annual studies have been conducted to determine the effect of fluorine emissions from an aluminum factory in the Hron valley, central Slovakia, on local vegetation. The checkered pattern of phytopathological symptoms observable on individual plants is the result of irregular diffusion and dispersion of pollutants, unequal intake of nutrients, and unequal physiological processes taking place in different parts of a plant. Different degrees of resistance to pollution encountered among plants of the same species are explained by plant location. In June 1968, large necrotic markings appeared on plant leaves, and the growth of plants relatively resistant to fluorine was inhibited. The spontaneous appearance of necrosis might have been provoked by a gradual accumulation of fluorine in the soil surrounding plant roots, finally reaching toxic levels, or by a sudden increase in fluorine concentrations emitted to both air and soil. The period of spontaneous necrosis was found to coincide with a period when, because of technical adjustments, factory emissions of fluorine were double the average of previous years. It is concluded that plants can serve

as indicators of increased fluorine emissions resulting from modifications of electrolytic installations or breakdowns in operating procedures. (Author abstract modified)

6129 APTIC NUMBER 15559

Heck, Walter W.
FACTORS INFLUENCING EXPRESSION OF OXIDANT DAMAGE TO PLANTS.
Ann. Rev. Phytopathol., vol. 6:165-188, 1968. 101 refs.

The sensitivity of plants to oxidants, conditioned by a number of external factors to which the plants are exposed, was reviewed. Research supports the thesis that the stomatal apparatus must be open before the phytotoxicant can enter the sensitive mesophyll areas of the leaf and cause damage. There is both direct and indirect evidence to support the view that the stomata are only a pathway for the entrance of the pollutant, and not the primary mechanism controlling injury. It was suggested that the mechanism which controls resistance of plants to oxidant pollutants may be similar to the one which controls resistance to other extremes in the environment. Plants are more sensitive when grown under a short photo period and at low fertility levels. A long dark period prior to exposure increases sensitivity. Plants grown under low light intensities are more sensitive to ozone and less sensitive to peroxyacetyl nitrate (PAN). Low temperatures for one to several days prior to exposure or growth under drought conditions reduce sensitivity. Sensitivity at time of exposure increases with increasing light intensity and humidity. Sensitivity of plants exposed under natural conditions is affected more by light intensity than by temperature. High carbon dioxide levels at the time of exposure reduce sensitivity. Plants exposed under any soil conditions that produce a water stress in the plant show an increased resistance. Injury from PAN is mediated by a light-sensitive system within the plant. Sulfur dioxide acts synergistically with both ozone and nitrogen dioxide on sensitive plant tissues. The presence of pathogens may also affect sensitivity as well as a slight change in the micro-environment of a leaf. Plant sensitivity increases during mid-day exposure; it is also affected by maturity. (Author summary modified)

6130 APTIC NUMBER 15332

Hibben, C. R. and G. Stotzky
EFFECTS OF OZONE ON THE GERMINATION OF FUNGUS SPORES. Can. J. Microbiol., 15(10):1187-1196, Oct. 1969. 37 refs.

To determine whether air pollutants increase plant infection by fungi, an investigation was undertaken of the effects of low concentrations of ozone on the germination of detached conidia, ascospores, and sporangiospores from 18 saprophytic and plant pathogenic fungi. Germination data were calculated for spores on solid media, in liquid culture, and in a dry condition. Detached spores varied in germination after exposure on agar to 10 to 100 pphm ozone for 1 to 6 hrs. Large pigmented spores of Chaetomium sp., Stemphylium sarcinaeforme, S. loti, and Alternaria sp. were insensitive to 100 pphm. Spores of Trichoderma viride, Aspergillus terreus, A. niger, Penicillium egyptiacum, Botrytis allii, and Rhizopus stolonifer were reduced in germination primarily by 50 and 100 pphm for the longer exposures. Small hyaline spores of Fusarium oxysporum, Colletotrichum lagenarium, Verticillium alho-atrum, and V. dahliae were the most sensitive; their germination was prevented or reduced by most exposures to 50 and 100 pphm and occasionally reduced by doses as low as 25 pphm for 4 and 6 hrs. Extended exposures up to 28 hrs reduced germination of A. Terreus, A. niger, and P. egyptiacum spores to below 50% of the controls. Lower doses of ozone sometimes stimulated spore germination. Fungus colonies maintained in an ozone atmosphere had abnormal growth characteristics. Ozone had little inhibitory effect on air-dried spores or spores in a liquid medium. (Author abstract modified)

6131 APTIC NUMBER 18962

Hill, A. C., E. R. Pack, H. Treshow, P. J. Downs, and L. G. Transtrum
PLANT INJURY INDUCED BY OZONE. Phytopathology, vol. 51:356-363, June 1961. 18 refs.

Phytotoxicity of ozone to 38 plant species was studied in controlled-atmosphere greenhouses. Plants were subjected at various stages of growth to 0.13-0.72 ppm ozone for 2-hour periods. Injury symptoms developed on 28 species. Some of the most sensitive species were small grains, alfalfa, spinach, and tobacco. There was a general tendency for sensitivity to increase with maturity of tissue. Palisade cells were most readily injured by ozone. On plants with adaxial palisade parenchyma, chlorotic spots and bleached necrotic areas developed on the upper leaf surface. Injury was equally apparent from either leaf surface of plants with undifferentiated mesophyll. Necrotic spots extending completely through the leaf developed on plants with either mesophyll structure when injury was severe. Ozone caused conspicuous tumors to develop on broccoli leaves. Symptoms similar to those produced by ozone fumigations were observed on a wide range of plant species growing near several large metropolitan centers. (Author summary modified)

6132 APTIC NUMBER 15674

Katz, Morris
SULFUR DIOXIDE IN THE ATMOSPHERE AND ITS RELATION TO PLANT LIFE. Ind. Eng. Chem., 41(11):2450-2465, Nov. 1949. 122 refs.

Recent studies of photosynthesis and respiration of plants in the presence of sulfur dioxide indicate in detail the effect of a wide range of concentration on alfalfa. The behavior of this species can be taken as typical of the reaction of plants most susceptible to SO2. Concentration from 0.10 to 0.20 ppm, in the absence of visible injury, did not decrease plant yield, photosynthesis, or respiration, or interfere with the march of the stomata, or deteriorate the chemical composition, protoplasm, or other plant structure. A reduction in yield and growth rate was correlated with definite leaf destruction or loss of foliage in

fumigations above 0.25. No basis was found for the theory of invisible injury. Environmental factors, such as low soil moisture, high relative humidity, light intensity, and rising temperature, which cause a high rate of sulfur dioxide absorption by leaves will render a plant susceptible to injury. If these factors are not prolonged, plants can be exposed to up to 0.40 ppm sulfur dioxide without injury. Concentrations from 0.10 to 0.20 ppm can have a beneficial effect, especially on sulfur-deficient plants. Even when concentrations are somewhat higher than 3.50 ppm, the effect on photosynthesis is only temporary unless the exposure is long enough to injure the leaf tissue.

6133 APTIC NUMBER 18089

Kobayashi, J., F. Morii, S. Muramoto, and S. Nakashima
EFFECTS OF AIR AND WATER POLLUTION BY HEAVY METALS (CD PB AND ZN) ON AGRICULTURAL PRODUCTS CAUSED FROM A MINE REFINERY IN GUNMA PREFECTURE. (Gunma-ken ka no ho kozan seiren go no hai gas oyobi nosaku butsu nado no gaikinzoku osen (Cd, Pb, Zn) ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):57, April 1969.

Pollution of plants growing on a hill by cadmium, zinc, and lead present in waste gases from a mine refinery was determined by atomic absorption spectrophotometric analysis of the elements following their extraction from dried and ashed plant samples. Plant distance from the refinery ranged from 400 to 2500 m, and plant content of metals varied with distance. Cadmium levels ranged from 17 to 3.3 ppm and zinc from 2590 to 360 ppm in mulberry leaves. The cadmium content of moss, greens, and eggplant leaves collected at 700 m from the refinery varied from 41 to 61 ppm and the zinc content from 2620 to 7010 ppm. Values were lower in corn, tomatoes, pumpkins, and persimmons. Taro, carrots, Welsh onions and burdochs showed medium values.

6134 APTIC NUMBER 15571

Korotayev, F. F., V. V. Kustov, G. I. Meleshko, V. I. Mikhaylov, and Ye. Ya. Shepelev
EFFECT OF SOME GASEOUS CONTAMINANTS IN THE ATMOSPHERE ON PHOTOSYNTHETIC ACTIVITY OF CHLORELLA. In: Problems of Space Biology, Volume 7 - Operational Activity, Problems of Habitability and Biotechnology. V. N. Chernigovskiy, (ed.), Moscow, Nauka Press, 1967, p. 475-480. 5 refs. Translated from Russian. National Aeronautics and Space Administration, Washington, D. C., p. 447-452, May 1969.
CFSTI: NASA TT F-529

Preliminary results are reported on the effects of both individual anthropogenic components of the inhabited atmosphere and a group of contaminants present in human expired air on photosynthesis of Chlorella. The action of ammonia, carbon monoxide, hydrogen sulfide, and acetone, and also air expired directly by man into the gas system of the gas exchanger were studied. Over a period of 4-6 hrs, the rate of photosynthesis was recorded under normal conditions of cultivation on the basis of the rate of absorption of CO2 from the air circuit of the system. After a rate of photosynthesis was established, the gaseous substance was introduced into the air circuit of the system and the rate of photosynthesis was again recorded for several hours. A slight stimulant effect on photosynthesis was observed, due to absorption of a considerable part of the ammonia from any gaseous phase. It was indicated that Chlorella utilizes ammoniacal forms of nitrogen in preference to other sources of nitrogen feeding. After introduction of carbon monoxide into the gas exchanger, the mean CO2 utilization by Chlorella cells increased in every case by 17-53%. The character of the changes in the rate of photosynthesis under the influence of acetone was similar to that observed during the action of carbon monoxide, but the intensity of the stimulant effect was significantly smaller. The maximal increase in the rate of absorption of CO2 was 28%. Hydrogen sulfide showed a marked inhibitory effect on photosynthesis, which was in full agreement with its blocking properties toward enzyme systems containing heavy metals. Expired air gave some evidence of slight inhibition of photosynthesis. In none of the experiments was there a stimulant effect obtained, which was nearly always observed in other experiments.

6135 APTIC NUMBER 15382

Kotaka, S., A. P. Krueger, and P. C. Andriese
THE EFFECT OF AIR IONS ON LIGHT-INDUCED SWELLING AND DARK-INDUCED SHRINKING OF ISOLATED CHLOROPLASTS. Intern. J. Biometeorol. (Leiden), 12(2):85-92, 1968. 9 refs.

Experiments were conducted to determine the effects of gaseous ions on isolated spinach chloroplasts maintained in a physiologically active state. Chloroplasts shrink when stored in the dark for 48 hrs at 4 C and swell again when illuminated. The rates of swelling and shrinking, determined by light-scattering techniques, are increased by exposure to both positive and negative air ions. If chloroplasts are preilluminated for 30 min, the rate of shrinking of air-ion-treated chloroplasts is increased. When the chloroplasts are illuminated again, the rate of swelling of air-ion-treated chloroplasts is lower than that of controls. If 2.5 mM of adenosine triphosphate (ATP) is added to the system upon the reillumination, the swelling rate of ion-treated chloroplasts is markedly increased. However, adenosine diphosphate (ADP), p-nitrophenyl phosphate, and inorganic phosphates are without effect. Prolonged illumination (5000 foot candles for 48 hr) or the addition of NaF inhibits the swelling and shrinking phenomenon. Exposure of the chloroplasts in the presence of ATP to unipolar ionized air of either charge at 4 C in the dark increases their swelling and shrinking and ATPase activities. These data suggest that air ions stimulate ATP metabolism of isolated chloroplasts.

6136 APTIC NUMBER 18833

Lamprius, Felix
THE BURKHARDTSWALD FOREST NEAR AUE AS A CLASSICAL EXAMPLE OF SMOKE INJURY PROTECTION. (Der Burkhardtswald bei Aue als klassisches Beispiel waldbaulicher Rauchschadenabwehr). Text in German. Abhand. Saechs. Akad. Wiss. Leipzig, Math.-Naturw. Kl., 20p., 1969. 48 refs.

A history of smoke injuries in the past 80 years in the Burkhardtswald forest near Aue, East Germany, is given, along with an evaluation of the protective measures which have been taken. The prevailing species in the Burkhardtswald is the spruce, although the climatic conditions are not the best for its growth. It is an area of moderate precipitation, almost not sufficient for coniferous trees. The entire forest is subjected to average SO2 emissions of 0.20 mg/cu m, mainly stemming from combustion of coal. For the past 30 years, extensive arsenic emissions have also affected the area. Their contribution to smoke injuries of trees has not yet been studied. Smoke injuries from SO2 on spruces and firs were observed in the forest as early as 1860; older trees were particularly affected. For the past several decades, dead or severly injured spruces and firs have been replaced by fast-growing Weymouth firs, red oaks, and birches. Unfortunately, no plan was established, so that in some areas, less valuable birch groves developed. Cultivation of Pinus nigra in this area is still in the experimental stage. In the future, Japanese firs will also be planted. On the average, it was found that beech trees are growing very well in the area, and no smoke injuries have been observed on them.

6137 APTIC NUMBER 14965

Lancaster, J. F.
A NOTE ON THE TOXICITY OF FORMALDEHYDE TO THE DEVELOPING CHICKEN EMBRYO. Can. J. Comp. Med. Vet. Sci., 26(6):139-140, June 1962. 8 refs.

Studies on the effects of formaldehyde on chicken embryos are reviewed. When 35 cc of formalin per 100 cu ft of incubator space were used, the second and third days of incubation were regarded as critical, with embryos at this state of development particularly sensitive to the toxic action of formaldehydes. Now that 128 cc-150 cc formalin per 100 cu ft are used in machines with minimum leakage of gas, the period of embryonic susceptibility (as measured by mortality) appears to be prolonged up to the 6th or even the 8th day of incubation. Beyond this incubation period, although formaldehyde fumigation does not affect hatchibility, there can occur an increasing number of malpositioned and malformed embryos. It appears that the malformed and malpositioned embryos occurred mostly among those embryos which would fail to hatch in any case. The toxicity of formaldehyde to the developing chicken embryo indicates the advantages gained by the method of fumigation prior to incubation. This method permits the use of gas-tight chambers and also provides a good opportunity to kill the microorganisms on the egg surface before they have time to penetrate the shell.

6138 APTIC NUMBER 15211

Maclean, D. C., O. E. Boark, G. Volkerts, and R. F. Schneider
INFLUENCE OF MINERAL NUTRITION ON THE SENSITIVITY OF TOMATO PLANTS TO HYDROGEN FLUORIDE. Environ. Sci. Technol., 3(11): 1201-1204, Nov. 1969. 10 refs.

The influence of calcium, magnesium, and potassium on growth, fluoride accumulation, foliar injury, flowering, and fruiting of tomato plants exposed to gaseous hydrogen fluoride was tested. Tomato plants grown in sand culture and provided with a complete nutrient solution or solutions deficient in calcium, magnesium, or potassium were exposed to concentrations of hydrogen fluoride from 0 to 15.1 micrograms/cu m for periods of three, five, or 60 days. In magnesium-deficient plants, HF exposure resulted in a reduction in the dry weight of both tops and roots and an increase in the severity of magnesium deficiency symptoms on basal leaves. Foliar accumulation of fluoride was suppressed by magnesium deficiency. The effects of HF exposure on calcium-deficient plants were characterized by reduced top growth, increased foliar chlorosis, and an enhancement of necrosis on apical leaves. Fluoride accumulation was unaffected by calcium nutrition. The responses of potassium-deficient plants to HF were limited to increases in F accumulation and in necrosis on apical leaves. The differential responses of the elements to HF exposure were ascribed to differences in their mobility within plant tissues, the stability of fluoride salts formed, and/or their metabolic roles. (Author abstract modified)

6139 APTIC NUMBER 14966

Menser, H. A., Jr., H. F. Heggestad, and J. J. Grosso
CARBON FILTER PREVENTS OZONE FLECK AND PREMATURE SENESCENCE OF TOBACCO LEAVES. Phytopathology, 56(8):866-867, April 1966. 7 refs.

The purpose of this study was to investigate with a charcoal filter the relation of air pollution to ozone fleck and premature leaf senescence in the eastern USA where ozone concentrations are much lower than those observed in southern California. Two varieties of tobacco plants (Bel-W3 and Bel-B) were grown in identical plastic covered chambers that received either carbon-filtered or ambient air. Maximum measured ozone concentrations ranged between 2.0 and 8.88 pphm in the ambient air chamber, there was no ozone in the filtered air chamber. Neither ozone fleck nor premature leaf senescence developed on the leaves of plants grown in air passed through the activated charcoal filter. Plants grown in the ambient air displayed both flecking and premature senescence, and the symptoms increased concomitantly. Both Bel-W3 and Bel-B showed similar tendencies toward premature leaf senescence, although displaying different susceptibility thresholds. It is concluded that the leaf senescence observed in the ambient air resulted from initial destruction of tissue by air-polluting ozone rather than from poor moisture conditions or inadequate nutrition, factors commonly associated with leaf senescence.

6140 APTIC NUMBER 14963

Menser, H. A., H. F. Heggestad, and O. P. Street
RESPONSE OF PLANTS TO AIR POLLUTANTS. II. EFFECTS OF OZONE CONCENTRATION AND LEAF MATURITY ON INJURY TO NICOTIANA TABACUM. Phytopathology, 53(11):1304-1308, 1963. 21 refs.

The relation of ozone concentration, leaf maturity, and resistance of 4 tobacco varieties was investigated by exposing greenhouse plants to ozone in a carbon-filtered, fumigation chamber. Replicated, 2-hr experiments at 0.10, 0.16, 0.22, and 0.28 ppm ozone showed the 4 varieties exhibited 3 sensitivity levels. Bel-W3, a weather-fleck sensitive selection, was injured at 0.10 ppm, while 0.22 ppm ozone was required to damage the fleck-resistant Bel-B variety. Ozone sensitivity was inversely related to leaf maturity, as determined by rate of leaf expansion. Recently mature leaves were more ozone-sensitive than overmature or rapidly expanding leaves. Ozone lesions were uniformly distributed over the upper surface of recently mature leaves; only tips of expanding leaves were damaged. The maturity-related pattern of injury in some respects resembled Los Angeles smog injury to Nicotiana glutinosa. (Author summary modified)

6141 APTIC NUMBER 15578

Ordin, L. and T. T. Teng
PEROXYACETYL NITRATE INDUCED INHIBITION OF GREEN PEA STEM GROWTH. Preprint, California Univ., Riverside, Dept. of Biochemistry and Statewide Air Pollution Research Center, 11p., 1968(?). 8 refs.

Preliminary data are reported for the effect of peroxyacetyl nitrate (PAN) on growth and cell wall metabolism in stems from nine-day old peas. Gassing of intact plants in light with 2.8 ppm PAN for 11 hours inhibited stem growth by 32%. Decapitated plants showed 45% inhibition of growth but decapitated plants treated simultaneously with 1% idoleacetic acid (IAA) and 1% gibberellic acid (GA) showed only 15% inhibition. However, damage to residual leaves was seen even on the hormone treated plants. Treatment of plants with 5.8 ppm PAN in darkness produced neither leaf damage nor inhibition of growth. Plant sections treated with 2.7 ppm PAN adsorbed and respired added glucose at control plant rates or slightly more rapidly, but cell wall metabolism was inhibited. Excised sections exposed to 23 ppm PAN in darkness or in light grew less than controls when subsequently placed in KCl growth solutions. Added IAA reduced growth inhibition in these excised sections. The data suggest that intact plant stems do not absorb enough PAN in darkness for their metabolism or growth to be affected at levels affecting them in light. The mechanism by which excised sections absorb PAN in darkness presumably does not involve light. The inhibition of intact stem growth in the light might be due to an insufficiency of auxin and/or nutrients leading in turn to inactivation of growth-maintaining enzymes or to the formation of inhibitory products from auxin which after transport react with the enzymes. The role of endogenous auxin remains to be investigated.

6142 APTIC NUMBER 15578

Peterson, Eugene W.
CARBON DIOXIDE AFFECTS GLOBAL ECOLOGY. Environ. Sci. Technol., 3(11):1162-1169, Nov. 1969. 10 refs.

Atmospheric concentrations of carbon dioxide are projected to the year 2000 and beyond, and the effect of anticipated influence on weather and global ecology are discussed. By 2000, if the burning of fossil fuel is not curtailed, atmospheric CO2 will increase 20-60% above 1950 levels to about 415 ppm. The CO2 will increase still another 30% by 2020 to 540 ppm. These amounts could increase average global temperatures by 1-5 F. Accompanying increases in plant growth may occur and result in a net reduction of atmospheric CO2. The increased growth rate of land and marine plants will more likely be balanced by an increased decay rate of plant material. Measurable melting of ice caps is anticipated by 2000, leading to a rise in ocean levels and major increases in earthquakes and volcanic activity. Techniques to reduce the CO2 content of the air or speed its absorption by oceans are theoretically possible but economically unfeasible. More practical methods of controlling CO2 emissions would substitute water power, geothermal steam, direct solar energy, and nuclear power for energy derived from fossil fuels. Research programs to determine the long-term effects of atmospheric CO2 are imperative. The U. S., as a major fuel oil consumer, should be a major participant in such research.

6143 APTIC NUMBER 15535

Price, Harvey Edward
THE EFFECT OF OZONE ON LIPID PRODUCTION IN THE FUNGUS HELMINTHOSPORIUM SATIVUM. Utah Univ., Salt Lake City, Dept. of Botany, Thesis(MS), May 1968. 23p., 8 refs.

Lipid production in the fungus Helminthosporium sativum was studied in relation to the presence of intracellular globules observed in ozone-treated cultures. Cultures fumigated at concentrations above 35 pphm for 144 hrs exhibited a significant decrease in lipid content following exposure, an increase in radial growth size and wet weight, and alterations in mycelial growth patterns above the agar surface. No changes were evident in the fatty acid composition of the lipid extracts, indicating that ozone suppresses lipid synthesis. The decrease in lipid production suggests that the globules observed in the hyphal tips of ozone-treated mycelia do not contain neutral lipid substances. The presence of the globules in the hyphal tips is more likely to be associated with ozone-induced damage than the production of vacuolar lipid material. It is hoped that further investigations at lower ozone concentrations of the alterations in mycelial cell growth will reveal the threshold limit below which aerial growth will develop. Additional work at lower concentrations is also needed to obtain correlations between growth stimulation, lipid synthesis, aerial growth, and cell damage.

6144 APTIC NUMBER 14936

Seki, Tatsuya
AIR POLLUTION IN THE INDUSTRIAL AREA ON THE NORTHEASTERN COAST OF TOKYO BAY. (2ND REPORT). (Keiyo rinkai kogyochitai no taiki osen). Text in Japanese. Kishocho Kenkyu Jiho (Journal of Meteorological Research) (Tokyo), 21(4):216-223, March 1969. 6 refs.

The unusually poor 1966 pear harvest in Tchihara called attention to the air pollution problem. The Pear Damage Research Council was organized, and large-scale research activities were undertaken with the cooperation of the Chiba Weather Station. It was clear from the data gathered in the area that pear damage was sensitive to the low rainfall of the 1966 season. Analysis of ambient pollution showed that rain was naturally low in acidity with a pH of 5.5-5.6, but sulfuric acid and ammonium vapors from nearby plants increased or decreased the acidity. Various factors which could be involved in pear damage, such as winds and the relationship of rainfall to sulfur dioxide concentration, were investigated. The period from April through May is crucial to pear flowering and differentiation. The Pear Damage Research Council was able to apply its findings the next year to attenuate pear damage.

6145 APTIC NUMBER 15898

Skye, Erik
THE USE OF LICHENS AS INDICATOR AND TEST ORGANISM FOR ATMOSPHERIC POLLUTION. (Anvaendandet av lavar indikatorer och testorganisser pa luftfororeningar). Text in Swedish. Nord. Hyg. Tidskr. (Stockholm), no. 3:115-138, 1969. 51 refs.

The use of lichens as indicators of air pollution was reviewed. Some species occur on bark with a fairly low pH and others occur on moderately acid to almost neutral bark. The sensitivity of lichens to air pollution may be due to the fact that it is a dual organism. It was maintained that air pollutants kill the lichens. Different ways of using lichens as indicators and test plants were tried. It is sometimes practical to use individual species as indicators. One widespread specie in western Europe is Lecanora conizaeoides, which is particularly hardy and occurs as the only lichen on trees in towns and industrial areas. In order to estimate zonation around a source of damage, the number of species per tree or group of trees may be used. This method is practicable only under certain conditions. The composition of the lichen species provides a better indication of the degree and kind of air pollution than the epiphythe flora. An index of air purity may be used in the cartographical representation of the regions of air purity. A formula for the degree of cover and poleotolerance in the individual species by Trass was an attempt to obtain a numerical expression for the reactions of lichens to air pollution. The use of Hypogymnia physodes as a test organism was developed. The extent of damage to the lichens is recorded on infrared sensitive film and the damaged areas are measured with a planimeter. This method was tested on a limited scale.

6146 APTIC NUMBER 13624

Stoeckl, W. and M. Weiser
COPPER MANGANESE ZINC AND MAGNESIUM CONTENT IN ENDOCRINE ORGANS OF HORSES, CATTLE AND PIGS. (Kupfer-, Mangan-, Zink-und Magnesiumgehalt in endorkrinen Organen beim Pferd, Rind und Schwein.) Translated from German. Zbl. Veterinaermed, 15(2):877-879, July 1968.

In horses, cattle and pigs the content of copper, manganese, zinc and magnesium was determined in the pituitary, adrenal, thyroid, pancreas, ovary and thymus, and the mean values and standard deviations were determined. Within the same animal there were considerable variations of each element as between the different endocrine glands and similar significant differences from one animal to another. These results are not extensive enough to permit any conclusion on the relationship of the examined elements to the endocrine function or their influence on the enzyme activity.

6147 APTIC NUMBER 15307

Stupfel, M. and J. Godin
SYSTEM FOR THE PROLONGED EXPOSURE OF SMALL ANIMALS TO AUTOMOBILE EXHAUST FUMES. (Dispositif pour l'exposition prolongee de petits animaux aux gaz d'echappement de moteurs automobiles). Text in French. Pollut. Atmos. (Paris), 11(43):127-130, July-Sept. 1969. 7 refs.

An installation is described which allows a comparative study of the effect of prolonged exposure to a dilution of exhaust fumes on rats, mice, and rabbits. The installation consists of two transparent chambers which are divided into three compartments each. One chamber receives pure air and the other receives air with the addition of an adjustable concentration of exhaust fumes from an automobile engine. The temperature, hygrometry, barometric pressure, lighting, and ventilation are constantly monitored inside the chambers where the animals are kept. Infrared analyzers measure the amount of carbon monoxide, carbonic acid, hexane, and oxygen at the engine outlet before dilution and in the exposure chamber after dilution. Each chamber is ventilated by air at the rate of 100-300 cu m/hr, and carbon dioxide is kept at a level of 0.03%. Temperature is maintained between 18 and 20 C with 50-60% relative humidity.

6148 APTIC NUMBER 15158

Tanivama, Tetsuro and Hiroki Arikado
STUDIES ON THE MECHANISM OF INJURIOUS EFFECTS OF TOXIC GASES ON CROP PLANTS. XVI. ON THE DEGREE OF INJURIES AND A KIND OF TYPICAL SYMPTOM OF INJURIES CAUSED BY H2SO3 SOLUTION SPRAY TO RICE PLANTS. (Sakubutsu no gasu shogai ni kansuru kenkyu. Dai 3 ho. Aryusansui no yomensanpu ni yoru suina no shogai to shogai teido ni tsuite). Text in Japanese. Nippon Sakumotsu Gakkai Kiji (Proc. Crop Sci. Soc. Japan), 38(2):222-228, June 1969. 15 refs.

Two kinds of symptoms typical of injuries caused by sulfur dioxide as H2SO3 were observed on the leaf blades and sheaths of paddy rice; one was multiple brown spots and the other was white lesions. These symptoms were observed at the leaf tip, between the veins, and sometimes at the edges of the blades and sheath. To prove that these symptoms were actually due to SO2, rice plants were sprayed with H2SO3 solution both during the day and at night. Only brown spots were observed; decrease in chlorophyll was directly proportional to the amount of acid sprayed, and the most severe damage was inflicted on the leaves in the third and

fourth position from the top. Sulfur content was higher in leaves sprayed during the day than in those sprayed at night.

6149 APTIC NUMBER 15518

Taylor, O. Clifton
IMPORTANCE OF PEROXYACETYL NITRATE (PAN) AS A PHYTOTOXIC AIR POLLUTANT. Preprint, Air Pollution Control Assoc., Pittsburgh, Pa., 24p., 1968. 25 refs. (Presented at the Air Pollution Control Assoc., Annual Meeting, 61st, Saint Paul, Minnesota, June 1968, Paper 68-168.)

Peroxyacyl nitrates are a family of compounds resulting from photochemical reactions between contaminants released to the atmosphere by combustion of organic fuels. Peroxyacetyl nitrate (PAN) is the most abundant member of this family and is responsible for serious plant injury in some polluted areas. Plant injury has been recognized in at least 19 states and several foreign countries, but economic loss causes greatest concern in California, where levels of the toxicant frequently exceed those required to produce plant injury. Characteristically, injury from PAN appears as glazing or bronzing of the lower leaf surface, but the symptom syndrome also includes tissue collapse, chlorosis, and leaf drop. PAN inhibits activity of several enzyme systems by attacking the sulfhydryl group when enzyme extracts are fumigated in vitro. PAN can produce visible symptoms when sensitive plants are exposed for 4 hours to about 14 ppb. Other members of the family (peroxypropionyl nitrate, peroxybutrye nitrate, and peroxybenzoyl nitrate) are more toxic than PAN. Concentrations of 20 to 30 ppb PAN are common in Riverside, California, where a maximum peak of 58 ppb was measured for one 2-hour period. Peaks as high as 58 ppb in Salt Lake City and 210 ppb in Los Angeles, have been reported. Peroxyacyl nitrates are also important eye irritants in atmospheres contaminated by effluents from organic combustion.

6150 APTIC NUMBER 14786

Ter Haar, Gary L., Richard P. Dedolph, Richard B. Holtzman, and Henry P. Lucas, Jr.
THE LEAD UPTAKE BY PERENNIAL RYEGRASS AND RADISHES FROM AIR, WATER AND SOIL. Environ. Res., 2(4):267-271, 1969. 11 refs.

The lead content of food is the major source of an increase of lead in modern man. The lead content of fruits and vegetables as well as meats may be derived from soil, air, rainwater, and food processing. A study to investigate the relative contributions of soil, air, and water to the lead content of plants is described. Grass and radishes were grown in a specially constructed growth chamber with either normal or filtered air, while either distilled or lead-containing water was applied to the leaves or to the soil surface. A randomized complete block experimental design was employed with factorial arrangement of treatments; results were analyzed by the associated analysis of variance technique. The lead content of grass grown in filtered air was 2.5 micrograms/g while that grown in unfiltered air was 5.2 micrograms/g. These values are different at the 1% level of significance. The uptake of lead from the water applied either to the foliar parts or to the soil surface was not significant at the 5% level. The lead concentration of either radish leaves or edible parts did not differ greatly for any treatment at the 5% level, and was the same as for grass grown in filtered air. These measurements indicate that half of the lead content of grass and nearly all of that in radishes was obtained from the soil with little absorption from simulated rainfall. Although the study is judged too limited in scope to define the relative contribution of soil and airborne lead to the human body burden, it has indicated that a substantial fraction of the lead in man's food may be obtained from the soil. Variables other than those studied may be of importance, including soil type, pH value, and lead concentration, plant type, and seasonal effects.

6151 APTIC NUMBER 14287

Treshow, Michael and Frances M. Harner
GROWTH RESPONSES OF PINTO BEAN AND ALFALFA TO SUBLETHAL FLUORIDE CONCENTRATIONS. Can. J. Botany, vol. 46:1207-1210, Oct. 1968. 12 refs.

A study was conducted to determine whether sublethal doses of fluoride impaired or stimulated the growth of Pinto bean and Ranger alfalfa plants. When bean plants were fumigated with fluoride, growth was accelerated and internode development was conspicuously greater than in control plants. Fresh and dry plant weights were positively correlated with increasing fluoride content of the leaves. Statistically significant correlation coefficients of 0.91 and 0.98 were calculated between fluoride content and fresh and dry weights, respectively. When fluoride content exceeded approximately 200 ppm, weights decreased below those of the controls. Leaf chlorosis did not develop until foliar fluoride concentrations exceeded approximately 500 ppm. Fluoride sometimes stimulated growth of alfalfa, but results were inconsistent and no statistically significant relation existed between foliar fluoride content and plant weight. However, dry weight of fumigated plants whose foliar fluoride content exceeded 500 ppm was only 63% that of the control plants. No chlorotic or necrotic markings were observed on fumigated alfalfa plants. An understanding of the mechanisms for fluoride stimulation requires further investigation into morphological responses. (Author abstract modified)

6152 APTIC NUMBER 15501

Treshow, Michael, Franklin F. Anderson, and Frances Harner
RESPONSES OF DOUGLAS-FIR TO ELEVATED ATMOSPHERIC FLUORIDES. Forest Sci., 13(2):114-120, 1967. 8 refs.

The response of Douglas fir trees to fluorides was studied near a phosphate reduction plant in Idaho, where about 200 acres of timber had been killed. Study trees, selected at increasing distances from the operation, were placed into groups according to the average fluoride content of the leaves. Radial growth, needle length, and dry weight of the trees in the various groups were compared before and during the operations. Radial growth

of trees with a fluoride concentration under 50 ppm (the controls) was greatest when the phosphate plant was operating; at higher concentrations, radial growth was the least during operations, and significantly less than in the controls, even in the absence of leaf necrosis. Normal growth resumed following the closing of the phosphate plant. Needle growth followed an opposite pattern. Needle length was positively correlated with fluoride levels and negatively correlated with radial growth. Stimulation of needle elongation appeared to be the easiest response of needles to fluorides. Growth suppression was evident at higher concentrations. Needle burning and mortality developed when fluoride concentration of the leaves exceeded several hundred ppm. (Author abstract modified)

6153 APTIC NUMBER 14351

Weaver, G. M. and M. O. Jackson
RELATIONSHIP BETWEEN BRONZING IN WHITE BEANS AND PHYTOTOXIC LEVELS OF ATMOSPHERIC OZONE IN ONTARIO. Can. J. Plant Sci. (Ottawa), vol. 48:561-568, Nov. 1968. 13 refs.

Studies on the effects of ozone were conducted in the laboratory and at three field locations in Ontario. Controlled exposure studies indicated that white beans are sensitive to at least 8.4 pphm (parts per hundred million) ozone after 6 hrs of exposure. The array of symptoms include necrotic stipple through disruption of the palisade parenchyma, chlorosis, blanching, and leaf and pod abscission. Leaf maturity also modified sensitivity to ozone. Concentrations of ozone as high as 9 pphm were detected during mid-August in association with the incidence of the bronzing disorder of white beans in three regions of Ontario in 1965 and 1967. The disorder is characterized by the sudden appearance of a bronze-colored necrotic stipple of pods and the upper surface of the leaf, followed by chlorosis and abscission of both leaves and pods. Conformity between field symptomatology of bronzing and the symptoms arising from controlled treatment with ozone strongly suggests that present levels of ozone in the atmosphere are phytotoxic, predominantly in mid-August, causing widespread damage to white bean plants. The stage of leaf metabolism and differentiation appears to affect ozone sensitivity and, consequently, factors affecting leaf physiology will modify the extent and severity of bronzing. Since the necrotic stipple appears rapidly after ozone exposure, the extent of stipple has diagnostic value in timing these occurrences. However, bronzing continues to debilitate the plants after phytotoxic exposures, because of the progressive chlorosis and abscission of both leaves and pods.

6154 APTIC NUMBER 15561

Wentzel, Karl-Friedrich
PROTECTION OF THE ENVIRONMENT AGAINST IMMISSIONS. (Landschaftsschutz gegen Immissionen). Text in German. Angew. Botan., 40(1/2):1-11, May 1966. 28 refs. (Presented at the Botanical Conference, Bonn, Sept. 10, 1965.)

Gas exposure experiments with plants do not reflect their relative resistance to air pollutants in nature. For example, such experiments showed that vegetables are the plants most sensitive to air pollutants. If the environment is observed closely, however, it will be found that deciduous trees show symptoms of air pollution damage much earlier. This can be explained by the fact that vegetables are frequently protected by buildings or trees. Thus, plant resistance cannot be evaluated correctly without taking the environment into account. With this approach, it can be concluded that coniferous trees are hardest hit by air pollution. If they grow in the vicinity of a deciduous forest, they will disappear first. However, crops and deciduous trees can still be grown in industrial areas. There are three ways to protect coniferous trees in an industrial area: by good stack gas dispersion using high stacks; by cleaning the raw material or by using non-toxic material; and by removing dust and pollutants from the emissions. Despite such measures, a minimum of air pollution will remain. In view of this fact, pollution-resistant plants ought to be selected for cultivation in such areas; their growth conditions (soil, water supply, etc.) must be optimized, and a belt of protective plants must be created.

6155 APTIC NUMBER 15404

Yu, Ming-ho and Gene W. Miller
EFFECT OF FLUORIDE ON THE RESPIRATION OF LEAVES FROM HIGHER PLANTS. Plant Cell Physiol. (Tokyo), vol. 8:483-493, 1967. 28 refs.

The effect of fluoride on the respiration of leaves from Chenopodium murale and soybean (Glycine max, Merr., Hawkeye variety) was studied to establish whether respiration changes induced by fluoride could be correlated with ADP concentration by the use of 2,4-dinitrophenol (2,4-DNP) as an uncoupler. Fluoride treatment included both excised leaves cultured in nutrient solutions and leaves from plants fumigated with hydrofluorice acid atmosphere. Tissues treated with low fluoride concentrations which initially showed increased oxygen uptake eventually showed decreased oxygen consumption. Tissues treated with a high concentration of fluoride showed an increased oxygen uptake if analyzed soon after treatment initiation. Increase in respiration generally took place before visible damage was manifested. Decrease in respiration was correlated with pronounced injury of tissues. Besides concentration of fluoride and the time lapse of treatment, the pH of the culture solution in which fluoride was supplemented, tissue age, and plant species were important factors affecting respiration. For example, the fluoride effect was greater at pH 4.5 than at other values tested and stimulation of respiration by fluoride was greater at all pH values when inorganic phosphate was added. The effect of 2,4-DNP on respiration was very similar to that of fluoride in that the effect differed with pH, concentrations, time of treatment, leaf age, and plant species. The respiration of fluoride-treated leaves was stimulated less by 2,4-DNP than that of control leaves. (Author abstract modified)

6156 APTIC NUMBER 18881

Ailor, William H., Jr.
ALUMINUM CORROSION AT URBAN AND INDUSTRIAL LOCATIONS. Proc. Am. Soc. Civil Engrs., 95(ST10):2141-2160, Oct. 1969. 91 refs.

Results of long-term studies of aluminum corrosion are presented. Panels of various aluminum alloys were exposed at five test sites: Richmond, Va.; Chicago, Ill.; Phoenix, Ariz.; Manila, Philippine Islands; and Widnes, Eng. At the end of each exposure period (1 year, 2 years, and 7 years), the panels were evaluated. In addition to the 7 aluminum alloys tested, panels of mild steel and pure zinc were also exposed for reference and comparison. A number of conclusions are presented on the basis of these exposures in urban and industrial locations. Corrosion of aluminum in industrial atmospheres generally takes the form of pitting. Pitting and corrosion of a clad material generally was confined entirely to the cladding alloy. No loss of mechanical properties was noted for the clad alloy 3003-H14 after 7 yrs of exposure. Some property losses for bare aluminum alloys were found for the severe environments at Chicago and Widnes. The bare aluminum panels were much superior in corrosion resistance to the mild steel in industrial locations. The bare aluminum alloys showed relatively high initial corrosion rates which decreased rapidly over the 7-yr period. Depth of pitting increased at a much reduced rate after 2 yrs of exposure. The Widnes, England, site was most severe, followed by Chicago. The Manila and Richmond locations were comparable in corrosivity. The Phoenix environment was least corrosive to aluminum, steel, and zinc. The references are included in an appendix which is a comprehensive listing of published articles relating to corrosion of aluminum in urban and industrial environments.

6157 APTIC NUMBER 18700

American Welding Society, Inc., New York, Committee on Metallizing
CORROSION TESTS OF METALLIZED COATED STEEL. 12-YEAR REPORT. AWS-C-2.11-67, 23p., 1967.

As a part of an 18-year study of the corrosion protection afforded by metallized aluminum and zinc coatings applied to low-carbon steel, results are presented of an inspection of the metallized coated steel panels made after a 12-year exposure period. Panels were tested at seven atmospheric exposure sites in the U. S., all of which exhibited some degree of either saline or industrial contamination; at sea water sites, exposure included full and half-tide immersion in quiet sea water and full immersion in flowing sea water. The preparation and inspection of the panels are described, and detailed results are presented. It is concluded that the base metal is still protected from corrosion in the atmosphere after more than 12 yrs of exposure by all thicknesses of aluminum coating tested, both sealed and unsealed, and by all sealed and unsealed zinc coatings of six mils thickness or over. In sea water, vinyl sealed aluminum coatings also provided complete protection from corrosion of the base metal. The base metal preparation method apparently has no effect on corrosion protection. Vinyl sealed aluminum coatings perform extremely well in all environments. For atmospheric exposures, sufficient vinyl should be applied to provide a reasonably smooth surface, both for appearance and for maximum corrosion resistance. Indications are that there are very few applications where sealing may be omitted. There is no evidence so far to show that aluminum coatings six mils and over in thickness have any advantage over three mils coatings in atmospheric exposures. Some industrial atmospheres cause rapid attack on unsealed zinc, but vinyl sealed zinc coatings perform extremely well in this type of environment. Sealed and unsealed zinc coatings perform well in mild to moderate marine atmospheres. Sprayed zinc coatings are not suitable for sea water immersion except in very specialized applications. Part II gives tabulated inspection data for each test site, together with a detailed account of each test panel type at each site.

6158 APTIC NUMBER 18915

Asseff, Peter A.
ENGINE PERFORMANCE AS INFLUENCED BY LUBRICANT DETERIORATION. Preprint, Society of Automotive Engineers, Inc., New York, 18p., Oct. 1968. 27 refs. (Presented at the National Fuels and Lubricants Meeting, Tulsa, Okla., Oct. 29-31, 1968, Paper 680760.)

Tests used for the evaluation of drain oils were discussed. An attempt was made to cover the significance of each test in terms of lubricant condition and anticipated effect on engine performance wherever possible. The use of insolubles measurements in the evaluation of oil dispersancy appeared promising. Chemical changes in a lubricant were evaluated by infrared absorption which enables one to determine changes which are not too readily detectable by other means. This is also useful in determining the effective life of a lubricant. Total acidity measurements determine the extent of oil acidic contamination and oil oxidation. The significance of this acid measurement is not too well established in terms of the effect on engine performance, with the exception of the strong acid measurement. The total acid number under certain conditions may be indicative of bearing corrosion potential. The total alkalinity value appears to be significant in terms of corrosive wear, varnish deposition, and moisture corrosion or rusting. Higher alkalinity values appear to give better performance along these lines in modern crankcase lubricants. The viscosity of a lubricant is affected by fuel dilution, oil oxidation, and suspended particulate matter. It is helpful in determining whether the internal friction in the oil is too high or low for satisfactory lubrication, or whether the flow properties are unsatisfactory for proper performance at high and low temperatures. Dynamometer tests on drain samples from the field determined the effect of the accumulated contaminants on the engine. Wear appears to be directly proportional to the concentration of contaminants. Rust and sludge ratings also depreciated as the concentration of contaminants increased. Studies in taxicab tests confirmed the laboratory results on the relationship between contaminants and wear. (Author summary modified)

6159 APTIC NUMBER 15908

Bryanza, A. P., F. S. Pynskaya, P. D. Reznichenko, and I. P. Mnuskin
THE ATMOSPHERIC CORROSION OF NICKEL POWDER IN THE PRESENCE OF SULFUR DIOXIDE. Soviet Powder Metallurgy and Metal Ceramics (English translation from Russian of: Poroshkovaya Met.), 8(75):214-216, March 1969. 15 refs.

In an investigation of atmospheric corrosion of factory-reduced nickel powder, it was found that at sulfur dioxide concentrations of 0.1 to 1.0%, the critical humidity is 55-56%. The corrosion of nickel increases with an increase in sulfur dioxide concentration from 0.05 to 1.0% and also under the influence of light. At sulfur dioxide concentrations of 1.5% the rate of corrosion is slower. Catalytic oxidation of sulfurous acid to sulfuric acid takes place at the nickel powder surface; this promotes an anodic reaction that destroys the protective film on the metal, and corrosion proceeds mainly with oxygen depolarization. In areas covered with a thicker film of moisture, partial reduction of the sulfurous acid to the sulfite ion takes place at humidities above the critical value, i.e., the principal cathodic depolarizer in these areas is sulfurous acid. (Author conclusions modified)

6160 APTIC NUMBER 14737

Baessler, K., H. Leib, and H. Spaehn
CORROSION IN REFUSE INCINERATION PLANTS. (Korrosionen an Muellverbrennungskesseln). Text in German. Mitt. Ver. Grosskesselbesitzer, 48(2):126-139, April 1968. 57 refs.

The state of the boiler furnace of a refuse incineration plant after 42,000 hours of operation is described. Despite a rather high HCl content in the flue gas, no extreme corrosion was found on the boiler tubes (maximum wall temperature 350 C). Points of high flue gas turbulence (which prevents incrustation) showed greater corrosion, but this occurred only at the transition from furnace to boiler. The pipe incrustations from various parts of the furnace were analyzed by chemical and X-ray fluorescence and X-ray fine structure methods. Microprobe measurements were also taken. The results showed that chlorides and sulfates are present in sufficient quantities to trigger and sustain chloride or sulfate corrosion processes. It was determined from a review of the literature that only at pipe wall temperatures greater than 400 C is there any heavy corrosion. Corrosion occurs at this point because the pipe incrustations begin to melt at these high temperatures.

6161 APTIC NUMBER 15657

Fink, Ferdinand
THE COMBUSTION OF DOMESTIC REFUSE CONTAINING A HIGH PROPORTION OF SYNTHETIC MATERIALS. (Verbrennung von Hausmuell mit hoeheren Kunststoffanteilen). Text in German. Brennstoff-Waerme-Kraft, 21(9):472-476, Sept. 1969. 8 refs.

The domestic refuse in the city of Zurich contained 1.1 to 2.7% by weight of synthetic material in the years 1963 and 1968, as compared with other large cities where it contained 4 to 5%. In Germany, half of the synthetics in domestic refuse are composed of polyvinyl chloride (PVC). The relatively low PVC fraction in the waste causes corrosion problems. Polyvinyl chloride begins to melt at 120 C; at 200 C, it begins to separate. It has a heating value of 6000 kcal/kg; the ignition point is 460 C. Domestic refuse is incinerated with a large amount of excess air. The heterogeneous waste composition causes a fluctuating combustion process. Thus, the waste gas composition varies as follows: 7 to 11% by volume CO, 10 to 16% water vapor, 6 to 10% oxygen, and 0.2 to 1.0 g/cu m HCl. Varying gas composition and fluctuating temperatures damage the oxide layer on the steel pipes. There are two types of corrosion: sulfate corrosion and chlorine corrosion. It is generally thought that sulfate corrosion is due to alkali pyrosulfates which, when superheated, yield activated SO3. The latter substance is highly corrosive. Chlorine corrosion is due to the presence of HCl. In oxidizing waste gases, HCl attacks only metal; in reducing waste gases, iron oxide and dust incrustations may adsorb HCl, which is liberated again at higher temperatures. The chlorine gas and the HCl which develop in this manner are both highly corrosive after desorption. To prevent chlorine corrosion, large amounts of water vapor must be present in the waste gas. Injection of water into the combustion chamber helps to fulfill this demand. Furthermore, reducing components in the waste gas must be avoided. The temperature at the pipe wall should never exceed 400 C.

6162 APTIC NUMBER 15679

Fujikawa, Fukujiro, Kunio Hirai, Teruhisa Hirayama, Mitsuo Fujii, Jitsuzo Makita, Fusako Sugiyama, Kazumi Ichinomiya, Jiro Takimoto, Hiroshi Yamada, Hiroshi Kawaguchi, Masaki Sawatari, Yukichi Matsuyama, Junichi Hada, Teiji, Matsutori, Masaaki Kadoma, Katsuji Okasak, Hiroshi Nakamura, Yasuo Mantani, and Nobuo Takeda
THE INFLUENCES OF AIR POLLUTION ON SOME CULTURAL ASSETS. I. ON THE AIR-POLLUTIONAL MEASUREMENT BY THE FILTER PAPER METHOD AND THE INFLUENCE OF AIR POLLUTION ON METALLIC LUSTER. (Taikiosen niyoru bunkazai nitaisuru eikyo (dai 1 po) anukarirosihho niyoru taikosennodo no sokutei to soreno kinzokukotaku nioyobosu eikyo nitsuite.) Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 15(6):377-387, Dec. 31, 1969.

Concentrations of sulfur oxides and nitrogen dioxide in the atmosphere were measured by an alkaline filter-paper method in the summer and winter at 100 locations in Kyoto. The grounds of shrines and temples where important cultural properties were placed were included on the study. A significantly higher concentration of sulfur oxides and nitrogen dioxide was observed in the winter than in the summer. The effect of the pollutants on the metallic luster of the cultural properties was also investigated. It was found that the rate of decrease in metallic luster was about 10% lower in winter than in summer. Although it was supposed that weather conditions were responsible for the decrease in metallic luster, a correlation was found between the concentration of sulfur oxides and rate of decrease in luster. No correlation was found for nitrogen dioxide concentration and luster. (Author abstract modified)

6163 APTIC NUMBER 14849

Guttman, Herbert
EFFECTS OF ATMOSPHERIC FACTORS ON THE CORROSION OF ROLLED ZINC. American Society for Testing and Materials, Philadelphia, Pa., Proc. Am. Soc. Testing Mater. 70th Annu. Meet., Metal Corrosion in the Atmosphere, Boston, Mass., 1967 (Spec. Tech. Publ. 435), p. 223-239, 1968. 8 refs. (June 25-30.)

The results of a study of the effects of atmospheric factors on the corrosion of rolled zinc are presented. It was shown that zinc is sensitive to variations in weather and atmospheric factors; as a result, zinc panels exposed at Birchbank, B. C., on different dates and for periods of up to 256 weeks corroded at different rates. Time of panel wetness and atmospheric sulfur dioxide content during the time that panels are wet exerted critical effects on the corrosion of zinc at Birchbank. An empirical equation relating corrosion to these factors was developed. This equation accounts for most of the weight loss variations observed. A relationship exists between time of panel wetness and relative humidity. A means of estimating time of wetness from relative humidity data is presented. The sulfation rate of lead peroxide is temperature-dependent. An equation was developed for estimating the atmospheric sulfur dioxide concentration from sulfur dioxide activity data, as measured by the lead peroxide candle method. The skyward surface of a zinc panel corrodes at a greater rate than the groundward surface when the rate is based on time of wetness. This observation is based on weight loss data from panels which were exposed for four-week periods. (Author summary modified)

6164 APTIC NUMBER 14849

Guttman, Herbert and P. J. Sereda
MEASUREMENT OF ATMOSPHERIC FACTORS AFFECTING THE CORROSION OF METALS. American Society for Testing and Materials, Philadelphia, Pa., Proc. Am. Soc. Testing Mater. 70th Annu. Meet., Metal Corrosion in the Atmosphere, Boston, Mass., 1967 (Spec. Tech. Publ. 435), p. 326-359, 1968. 18 refs. (June 25-30.)

Atmospheric factors, namely, time of wetness of corroding metal panels, panel temperature, and atmospheric sulfur dioxide and atmospheric chloride content, were measured at four inland and three coastal North American test sites while corrosion data for steel, copper, and zinc were being developed over a four-year period. Corrosion losses experienced by panels of these metals which were exposed at different times of the year for similar periods of time showed considerable variation at all sites. Statistical analyses show conclusively that the atmospheric factors measured completely control the rates of corrosion at all sites for at least the initial month. For longer periods of time, control of the corrosion process remains with the atmospheric factors in some cases, and in others it is gradually transferred to factors related to the changing surface conditions resulting from accumulation of corrosion products and foreign agents. The program confirmed that the methods used for measuring atmospheric factors are suitable for long term corrosion studies. At the sites where the atmospheric factors control corrosion, the empirical equations developed permit the prediction of corrosion losses in steel, copper, and zinc from a knowledge of the atmospheric factors. They also now make it possible to account for variations in observed corrosion losses experienced by panels exposed at different times of the year. (Author abstract modified)

6165 APTIC NUMBER 13816

Knotkova-Cermakova, Dagmar
THE SIGNIFICANCE OF CLIMATIC FACTORS FROM THE STANDPOINT OF ATMOSPHERIC METAL CORROSION. (Die Bedeutung der Klimafaktoren vom Standpunkt der atmosphaerischen Korrosion von Metallen). Text in German. Z. Meteorol., 20(1-6):126-132, 1968. 18 refs.

Atmospheric corrosion of metals depends critically on the relative humidity and the contamination of ambient air. While moisture facilitates the electrolytic process of corrosion, air contaminants affect its mechanism and kinetics. Further progress in corrosion research depends on close cooperation with sources of meteorological information. This review of work in this field contains some apparently original data of corrosion tests on samples of Fe, Zn, Cd, Cu, and Al in the Moscow and Zvenigorod (Russia) air. Liesegang's method of adsorption of atmospheric SO2 by cartridges saturated with Na2CO3 solution is more suitable for determining the NaCl content of air than adsorption by cartridges saturated with PbO2. Ambler's method of NaCl content determination is used by the meteorological stations of the USSR. In addition to the SO2 and NaCl contents of atmospheric air it is recommended that the amount and composition of airborne dust be included in meteorological information relating to industrial and urban regions.

6166 APTIC NUMBER 14926

Kobayashi, Y., T. Matsuzawa, G. Owashino, M. Saigo, T. Kuwajima, and S. Nishimura
STUDIES ON THE APPAYION OF AIR POLLUTANTS IN OUTDOOR AND INDOOR. (Gaiki oyobi shitsunai ni okeru taikiosen bushittsu no kodo ni kansuru chosakenkyu). Text in Japanese. Kuki Seijo (Clean Air-J. Japan Air Cleaning Assoc., Tokyo), 7(2):18-24, June 1969. 8 refs.

It is assumed that the major reason for telephone dialing trouble lies in air pollution. The purpose of this study was to check the influence of air pollutants on the stationary machines in a telephone exchange office. Fifteen offices were examined for the dust density outside and inside, the amount of dust accumulated on the floor and sulfur oxide, nitrogen oxide, and acidic gas concentrations. The outside dust density was as follows: Osaka area, 0.8-5 mg/cu m; Tokyo area, 0.1-1.2 mg/cu m, Yokohama area, 0.4-0.6 mg/cu m; and the others were 0.03-0.8 mg/cu m. The dust density indoors had a maximum of 1.2 mg/cu m in Osaka and a minimum of 0.02 mg/cu m in Aizuwakamatsu. The ratio of the dust density of the indoor air to office air and to exchange room air was 0.3:1:0.1. Dust density varied directly with height from the ground; maximum

concentration was recorded from the first to the third floor. Sulfurous acid erosion did not show a noticeable relation to dialing trouble, so it was thought that nitrogen oxides were responsible.

6167 APTIC NUMBER 15293

Kurtz, P. P., A. Tamsma, P. L. Selman, and W. J. Pallansch
EFFECT OF POLLUTION OF AIR WITH OZONE ON FLAVOR OF SPRAY-DRIED MILKS. J. Dairy Sci., 52(2):158-161, Feb. 1969. 7 refs.

In an investigation of seasonal variations in the flavor quality of milk powders a series of experiments was conducted in which low-heat, spray-dried milks were manufactured during a period of low background levels of ozone. The effect of ozone on the flavor of dried milks was ascertained by manufacturing powders both with and without addition of ozone to the dryer air, and subsequently evaluating their flavor by a trained taste panel. Levels of ozone reported by others as occurring in the atmosphere of the Washington area during the warm weather months were sufficient to lower substantially the flavor score of dried milks. Skimmilk powders manufactured in air containing 32 ppb ozone averaged 1.7 flavor points (on a ten-point scale) lower than those manufactured under a background level of 2 ppb. Under the same conditions, whole milk powders averaged 2.9 points lower than the control powders. Foaming heightened the damaging effect of ozone on flavor quality. Raising the ozone level from 32 to 52 ppb produced little or no further effect on the flavor of whole milk powder and only a questionable effect on the flavor of the skimmilk powder. From the data, it is obvious that whole milk powders suffer more than skimmilk powders, which suggests that the off flavor is produced by a reaction between the ozone and milk fat. It is not understood why the difference was not greater, since the fat content of whole milk powder is 30 times greater than that of skimmilk powder. It was concluded that to produce high quality milk powder, plants should be located in areas of relatively low air pollution or they should remove the pollutants from the drying air.

6168 APTIC NUMBER 15278

Mauss, W. P.
SULFURIC CORROSION IN HOT WATER HEATERS. (Corrosion sulfurique dans les chaudieres a eau chaude). Text in French. Rev. Ass. Fr. Tech. Petrole, no. 188:127-136, 1968. 19 refs.

This study showed that certain traditional findings on steam boilers have little application in the case of hot water boilers. According to the classic Hoffmann graph, the rate of corrosion has a maximum between the condensation temperatures of water and sulfuric acid from the fumes. In this range, relatively concentrated acid is deposited. Below the water condensation point, dilute acid with SO2 in solution condenses and causes very fast corrosion. In hot water heaters, oxidation of SO2 to SO3 takes place only in the flame and not on the walls. In these studies, fuel oils containing 0.5% and 2% sulfur were used. The rate of corrosion of a sample of soft steel and the rate of formation of an acid film on glass were measured, the latter with the B.C.U.R.A. apparatus. Temperatures of maximum potential corrosion, i.e., considering all deposited SO3 as being transformed into FeSO4, were never found, perhaps because the sulfur content or the rate of fuel consumption was too low. In a 318,000 metric ton (?) per hour furnace, the quantity of sulfur in the gas, before and after passing the heat exchanger, was measured to determine the mass of sulfur deposited. It was shown that water temperature had less influence on the deposition rate of SO3 than the air excess used in the burners, especially below 10% excess air. It is recommended that this be taken into account in the operation and design of water heaters.

6169 APTIC NUMBER 16332

Pope, D., R. B. Gibbens, and P. L. Moss
THE TARNISHING OF AG AT NATURALLY-OCCURRING H2S AND SO2 LEVELS. Corrosion Sci., vol. 8:883-887, 1968. 12 refs.

Experiments were carried out to measure the rate at which silver tarnishes (due to sulfide formation) with respect to levels of hydrogen sulfide, sulfur dioxide, and water vapor found under natural conditions. Hydrogen sulfide concentrations as low as 0.01-0.02 ppm or 0.02-0.05 ppm were used, which correspond with very bad natural conditions; 2 ppm SO2 was chosen as being consistent with the H2S level for bad conditions. On the basis of experimental results, the relative insensitivity to H2S concentration and the initial fast rates of sulfide formation indicate the need for caution in using accelerated tests with high concentrations of H2S to predict results for actual atmospheric H2S levels. The effect of moisture at very low H2S concentrations was pronounced and the rate of sulfide formation was more effectively reduced by lowering the humidity rather than the H2S level. Addition of sulfur dioxide (2 ppm) had little or no effect on the rate of sulfide formation on pure silver surfaces at the 0.02-0.05 ppm H2S level in dry or moist conditions. Iron contamination enhanced the rate of sulfide formation by 0.02-0.05 ppm H2S, but the addition of 2 ppm SO2 nullified the effect.

6170 APTIC NUMBER 15659

Powden, P.
ACID CORROSION AND SOOT EMISSION BY KILN EXHAUST GASES. Trans. Brit. Ceram. Soc., 68(5):227-239, 1969. 26 refs.

Over the past 10 years, oil firing of kilns by impulse injector systems has increased considerably in the heavy clay and refractories industries. The use of oil firing has reduced emissions of dark smoke but increased other problems connected with the sulfur content of fuel: the emission of sulfur oxide fumes from kiln chimneys, the emission of acid smuts, and the corrosion, by deposition of acid from exhaust gases, of exhaust fans, metal ducting, and metal stacks. These problems are aggravated when sulfur is also present in the clay. At present, all that can be done to reduce emission of sulfur oxides from oil-fired kilns is to use a low-sulfur-content fuel and to provide a chimney of sufficient height to disperse the gaseous pollutants so that ground level concentrations are kept within desired

limits. Smut emissions can be limited by providing efficient combustion to reduce the amount of carbon carryover and by preventing acid condensation and deposition. Preventing the condensation of acid is achieved by maintaining sufficiently high temperatures throughout the exhaust system or by injecting solid or gaseous alkalies, e.g., powdered dolomite and ammonia, into the exhaust gases. Neutralizing acids with dolomite or ammonia will also prevent or limit corrosion. Another corrosion preventive measure is the use of protective coatings such as sprayed aluminum, enamel, and plastic coatings.

6171 APTIC NUMBER 14695

Sadowski, Fritz
MUTUAL INTERFERENCE OF THE TEST OBJECTS IN THE KESTERNICH TEST. (Gegenseitige Beeinflussung der Prueflinge im Kesternich-Test). Text in German. Farbe Lack, 74(10):970-975, 1968. 10 refs.

The Kesternich method is used for testing various protective coatings to determine their resistance to SO2-laden air. Objects can be tested simultaneously only when they do not interfere with each other. However, it has long been claimed that most protective coatings have different abilities to adsorb SO2. Experiments with a glass panel, iron panels coated with a PVC plastisol, zinc oxide, zinc chromate, zinc dust paint, an aluminum panel, and a rusted iron panel verified this. Therefore, a new unit for corrosion resistance tests was devised, composed primarily of a tube in which the test objects are exposed to constantly renewed air. Such an apparatus excludes locally differing SO2 concentrations. This new apparatus was tested under the conditions stipulated by the DIN 50 018 standard, namely at 40 C and 100% relative humidity. Two cu m air per hour containing 10 liters of SO2 were passed through the 300 liter container. The experiments confirmed the theoretical assumption that in a flowing system, the test objects cannot interfere with each other.

6172 APTIC NUMBER 14363

Samuel, T. and M. Weise
THERMOGRAVIMETRIC METHOD FOR THE STUDY OF THE EQUILIBRIA SOLID STATE/GAS AND MELT/GAS IN SULFATE SYSTEMS IMPORTANT IN CORROSION CHEMISTRY. (Thermogravimetrische Methode zur Untersuchung der Gleichgewichte Festkoerper/Gas und Schmelze/Gas in korrosionschemisch wichtigen Sulfatsystemen). Text in German. Werkstoffe Korrosion, 19(10):837-844, Oct. 1968. 21 refs.

Many liquid sulfates are responsible for high-temperature corrosion. The stability of these sulfates depends on the partial pressure of sulfur trioxide. A method for determining the equilibrium partial pressure of SO3 is described. The SO3 concentration was determined by measuring the CO2 concentration developed according to the reaction Na2CO3 plus SO3 yields Na2SO4 plus CO2 by infrared spectrophotometry. The composition of the condensed phase was determined by weighing a small sample of the substance. Thus, the absorption of SO3 could be observed. Weight, IR absorption, and temperature were continuously recorded. The method is fully explained for the system Na2SO4 - SO3. The diagrams of state for the reaction Na2SO4 plus SO3 yields Na2S2O7 were determined. Uncertainties due to residual moisture and undercooling are discussed. These probably explain the large differences between the current results and those quoted in the literature. The system Na2SO4-SO3 has eutectic point at 390.5 C at an SO3 pressure of 2.57 mbar. The melting point of Na2S2O7 is 402 C. The system Na2SO4/K2SO4 has a eutectic point at 383 C and 1.58 mbar SO3. The eutectic point of K2SO4/SO3 is 411.0 C and 0.305 mbar SO3. The melting point of K2S2O7 is 417.5 C. It is concluded that the alkali pyrosulfates do not corrode gas turbines because of their low decomposition temperatures (435 C for sodium melts and 565 C for potassium melts). In boilers, however, they may play a significant role. The influence of water vapor has not yet been fully investigated.

6173 APTIC NUMBER 14876

Seguin, Richard L.
OPERATING DATA, DESIGN CRITERIA, RELIABILITY AND PRESENT CONDITION OF CHIMNEY LINERS AT VARIOUS CONSUMERS POWER COMPANY STEAM-ELECTRIC GENERATING STATIONS. Preprint 767, Am. Soc. Civil Engrs., New York, 33p., 1968. 9 refs. (Presented at the A.S.C.E. Annual and National Meeting on Structural Engineering, Pittsburgh, Pa., Sept. 30-Oct. 4, 1968.)

The operation and feasibility of various liners and coatings for chimneys of ten fossil-fueled electric power plants are reviewed. Performances of independent brick, corbel brick, and concrete liners are described under actual operating conditions. Included in the operating conditions are coal analyses, gas velocities, methods of firing, and unit loadings. Though some plants in the industry have found corbel brick liners unsatisfactory, no deterioration is reported for the liners when used in conjunction with fiber glass insulation and in chimneys having a maximum exit velocity of 60 fps. The linings resist corrosion when the sulfur and ash content of the coal used do not exceed 2 1/2% and 11%, respectively. Independent concrete liners with no protective coating also perform well under the above conditions. Periodic inspections reveal no penetration or deterioration of the concrete. Use of these liners has resulted in substantial cost savings. Independent brick liners coated with Stockfas are holding up well in chimneys with maximum velocities of 90 fps. Corrosion of the concrete floors of these chimneys is now prevented by cleaning devices for washing off fly ash. None of the chimneys discussed, some dating back to 1937, have required major repair work. However, stainless steel caps, which deteriorated rapidly, have been replaced by cast-iron caps. The degree to which the chimney liners can resist the highly corrosive unit train coal now being used is not known.

6174 APTIC NUMBER -----

Ruland Fritz
PHYSICAL TESTING AND CHEMICAL ANALYSIS OF COMBUSTION AIR AND BLAST FURNACE GAS DUSTS TO DETERMINE THEIR INFLUENCE ON GAS TURBINES. PART I: EFFECTS OF ATMOSPHERIC CONDITIONS ON DUST COMPOSITION. (Physikalische und chemische Untersuchung von Brennluft und Gichtgasstaeuben bei Gasturbinen. Text in German.

Teil I. Witterungseinfluesse auf die Staubzusammensetzung). Motortech. Z. (Stuttgart), 30(10):367-372, Oct. 1969. 8 refs.

Continuous dust measurements of the combustion air were made at three German metallurgical plants using a 'Gravikon' at a throughput of 30 to 50 cbm/h. Dust collected on special filters was dried at 50 to 60 C solved in trichlorethylene, filtered dried, and weighed. Waste-gas samples were taken with a throughput of 15 cbm/h. The measurements showed no relationship to high temperature corrosion. On comparing the chemical analysis of the dusts with meteorological data, it was discovered that the wind direction had a marked influence on the dust composition on turbines, primarily in connection with emissions on the plant premises. Rain increases the relative humidity and thus the moisture content of the dust; this, in turn, increases the amount of SO3. The Fe2O3 is washed out, NaCl increases slightly and the ZnO and K2O content increases. Rain and high relative humidity increase the concentration of highly corrosive components in the dust. Inversion layers prevent dispersion of the dust and increase the amount of SO3, K2O, ZnO, SiO2, CaO, and MgO.

5175 APTIC NUMBER 15907

Wright, William R.
METHOD AND APPARATUS FOR PREVENTING CONDENSATION IN A COLLECTION SYSTEM. (Ashland Oil & Refining Co., Inc., Houston, Tex) U. S. Pat. 3,464,180. 6p., Sept. 2, 1969. 3 refs. (Appl. June 21, 1965, 8 claims).

An improved process and apparatus for starting up and shutting down a carbon black production system are applicable to the preparation of furnace carbon black by partial combustion and/or thermal decomposition of a gaseous or liquid hydrocarbon. They eliminate the serious disadvantages of conventional starting up and shutting down procedures: wetting down of collection system internals and fabric filter bags; the long collection system warm-up period during which the reactor is operated at full heat load without producing any carbon black; and the condensation that occurs on the internal surface of the collection system, thereby reducing corrosion of the internal metal part. The apparatus of the invention includes one or more furnace-type carbon black reactors with a discharge outlet for carbon black and combustion gases and a collection system for separating carbon black from hot moisture-laden gases through which gases of relatively low moisture content circulate prior to the introduction of hot, moisture-laden gases. The system is readied for use by first passing through it gases whose dewpoint is higher than that of the collection system internals, then gases with a dewpoint lower than the internals. The system is readied for shutdown by passing through it heated gases of relatively low moisture content. Thus, at a given temperature the internals that have been used to collect solids from a first gaseous medium with a dewpoint above the temperature are purged with a second gaseous medium having a dewpoint below the temperature. Prior to its entry in the collection system, gas is heated in a combustion type heater.

ECONOMIC ASPECTS

6176 APTIC NUMBER 15258

Lahiri, Adinath, N. G. Basak, A. N. Basu, and D. K. Mukherjee
FEASIBILITY OF CONVERSION OF HIGH SULFUR TERTIARY COALS OF ASSAM TO ENERGY PRODUCTS AND CHEMICALS. Chem. Eng. Progr. Symp. Ser., 60(85):1-14, 1968. 26 refs.

Indigenous production of petroleum in India presently meets only 30% of the requirements and is unlikely to rise appreciably to supply more than a fraction of the growing demand of oil products, estimated to be around forty-five million tons by 1980. Also, there is a tendency of product imbalance. The lighter ends like gasoline are in excess of requirement, while others like middle distillates are in short supply. Oil reserves so far proved in India are located at the extreme ends, Assam in the northeast and Gujerat in the west. Coals of a peculiar nature and unlike those met with anywhere else belonging to the tertiary formations occur in north and south Assam. The total deposits are of the order of 4000 million tons, and those that occur within a few miles of the oil fields are estimated to be more than 2000 million tons. These coals have high organic sulfur (3 to 5%), low ash (3 to 4%), low moisture, give high tar yields (40 gal at 600 C), and occur in thick seams. The Central Fuel Research Institute investigated the possibility of utilizing these unique coals which, owing to their high sulfur content, have a restricted market in conventional industries. Alternative avenues for their exploitation for production of chemicals and substitute petroleum products are being explored. Availability of natural and associated gases in large quantities adds a further dimension to the possibility of hydrogenating these coals on commercial scale to liquid fuels. Unlike peninsular coals, the high sulfur tertiary coals of Assam are easily amenable to hydrogenation. High conversions are obtained even at 200 atm and at 400 C. The possiblity of utilization of Assam coal for the production of a synthetic crude and its hydrotreatment along with natural petroleum utilizing surplus natural gas for the production of hydrogen is outlined. Sulfur, phenols, and other chemicals can be obtained as by-products, which may have a favorable effect on the economy of such a project. The possibility of combining oil and coal refining, the availability of surplus and natural gas, and the amenability to hydrogenation of Assam coals occurring in close proximity to oil and gas present unique possibilities to coal-to-oil conversion not easily matched elsewhere. (Author abstract modified)

6177 APTIC NUMBER 15435

Levin, S. A. and P. Von Halle
APPLICABILITY OF A SEPARATION PROCESS FOR LARGE-SCALE ISOTOPE PRODUCTION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, Vol. 4:366-370.

The basic considerations which indicate the economic feasibility of a separation process are presented and their use is illustrated by evaluating an isotope separation process which utilizes the enrichment afforded by irreversible chemical reactions. Unimolecular decomposition equations show that it is possible to obtain material of any desired concentration in a single stage of the decomposition process. The drawback is the large amount of feed material which must be processed when the desired enrichment is high. For a more practical system, one must employ a cascade of stages. Cascade operations are simplified when the fraction of material reacted is 0.5; this 'cut' increases the reactant requirement by only 4% over the minimum amount of reactant. A cascade using an irreversible chemical reaction as the enrichment mechanism is different from one employing chemical exchange. In the chemical exchange process, the reversible exchange reaction takes place in conventional liquid-liquid or gas-liquid contacting equipment. It employs irreversible chemical reactions only at the ends of the cascades. The irreversible process involves an irreversible reaction and regeneration cycle at each stage of the cascade. To be competitive with the chemical exchange process, the irreversible chemical reaction process must have a separation factor significantly larger than that for the best chemical exchange process so that the total interstage flow of the irreversible process cascade is of the same order of magnitude as the interstage flow at the feed point in the chemical process exchange plant. When the performance values of the two processes are the same, the irreversible chemical reaction plant will be 50-90 times as expensive as the chemical exchange plant, depending on the enrichment level. Costs become competitive if the performance value of the irreversible process is 7-9 times that of the chemical process.

6178 APTIC NUMBER 18846

Norsworthy, J. R.
A COMPUTER SIMULATION SYSTEM DESIGN FOR ECONOMIC EVALUATION OF ALTERNATIVE AIR RESOURCE MANAGEMENT POLICIES. International Business Machines Corp., White Plains, N. Y., Data Processing Division, Proc. IBM Scient. Computing Symp. Water and Air Resource Management, Yorktown Heights, N. Y., 1967, p. 355-367, 1968. (Oct. 23-25.)

A computer system is described which will permit economic evaluation of alternative air resource policies through simulation of the meteorological environment. The system takes information on resources (population, buildings, etc.), air pollution emissions, sources of emissions, and meteorological data and estimates the total environmental experience of air pollutants by resources. From these estimates, the system derives three basic kinds of information: resource-oriented damage information, pollution source-oriented liability information, and pollution source abatement response to liability assessment. Edited output gives the name of the resource point, the total dollar cost, the type of damage, and, if desired, the name of the major effluent source or sources, with measures of uncertainty of each estimate. For each effluent source, the program estimates the marginal damage cost and type of damage for every affected resource point. The tax liability for each effluent source is computed by totaling the marginal costs of damage to every resource point. Response of each pollution source to the tax levy will in general take the form of abatement to some degree, providing new emission estimates. The new emission data are in turn used to generate new estimates of pollution damage.

6179 APTIC NUMBER 14588

Norton, S. G.
USE OF SULPHATE TURPENTINE AS A CHEMICAL RAW MATERIAL. TAPPI, 120(7):66, Feb. 1945. (Presented at the Byproducts Committee of the Technical Assoc. of the Pulp and Paper Industry, Savannah, Ga., Oct. 18-19, 1944.)

The alpha and beta pinenes that are derived from the crude sulfate turpentine obtained as a by-product from the sulfate process can be used in the production of many new commercial synthetics. Reactions involved in the creation of these materials include isomerization, hydration, dehydration, esterification,, etherification, oxidation, and polymerization. Examples of commercially produced pinene synthetics are insecticides, solvents, pine oil, cough remedies, perfume bases, and plasticizers. Many other products are awaiting introduction; all indicate an unlimited market for crude sulfate turpentine as long as its price remains stable and moderate.

6180 APTIC NUMBER 12170

Parrish, P. W.
EFFECTS OF AIR POLLUTION PROPERTY DAMAGE AND VISIBILITY. Preprint Duquesne Light Co., Pittsburgh, Pa., 12p., 1963. (Presented at the Pennsylvania Air Pollution Control Inst., Pennsylvania State Univ., University Park, Pa., Sept. 9-13, 1963.)

The cost of air pollution in the continental U. S. is in excess of six billion dollars a year. This is the cost of permitting and tolerating air pollution--not the cost of abatement, enforcement, research, or personal suffering. Six billion is the loss in property or property values and the increased burden of maintenance and premature replacement. The following is a possible breakdown of the different classes of material that fall prey to air pollution: masonry - stones, concrete, brick; metals in all forms structural, equipment, hardware; decorative and protective coating vegetation; textiles, rubber, plastics, leather, paper, insulation property values, art, sculpture, architecture, historical artifacts. Visibility reduction is also a result of air pollution These eight topics are briefly discussed to show the manner in which air pollution effects each one.

6181 APTIC NUMBER 14583

Ryczak, Stanley J.
BATCH PROCESSING OF TALL OIL. TAPPI, 46(2):129A-130A, Feb. 1963.

Considerations of capital costs, manpower requirements, and ease and flexibility of operations influenced the Cheasapeake Corporation's decision to adopt a batch, rather than continuous, system for crude tall-oil production. Although there is no 100% interface between the three layers obtained by separation in the cooking cycle, any lignin or spent acid carried over during the transfer of oil to the wet oil storage tank settles out in the tank and is periodically returned to the cook tank before the cleanout of the latter. Moisture in the wet oil storage tank is present as dissolved or suspended water. To avoid discoloration or oil degradation, temperatures are not raised to drive it off. In cooking, 66 Be sulfuric acid is added through a flowrater, and live steam is used to bring the temperature up to 212-216 F. Following acid addition and heating, a Viking gear pump charges the amount of soap skimmings desired. The desired pH of the spent acid is 4.1 to 4.2 since, at this point, there is almost no residual soap in the tall oil, or excess acidity to be corrosive to tanklines. Because considerable liquor separation takes place in the soap storage tanks over the two-week filling period and liquor is returned to the evaporation process daily, soap is relatively free of black liquor and less lignin is precipitated in the cook tank. To clean the cook tank, a mixture of white liquor and water, added to the remaining lignin fraction is first heated with agitation, then pumped to a holding tank where it burns. In this process, white liquor is recovered and the lignin burns to produce steam. The plant can produce 80 tons of crude oil a day.

6182 APTIC NUMBER 15450

Schoenhofen, Leo H.
TURNING INTO PROFITS SOME AREAS OF POLLUTION CONTROL. Flexography, 13(10):24, 26-27, 57, Oct. 1968.

The control of water pollution as it relates to the manufacture of paper and paperboard is discussed, particularly as it relates to making it into a profit opportunity. A Wabash mill reduced its water intake by half through a reappraisal and tightening of the system. A capital cost of $338,500 reduced the solids content of the water from 10 lbs per thousand gallons to 0.5 lb per thousand gallons. However, reclaimed fiber from this filtering system resulted in $38,000 yearly profit above the annual operating costs of the system. An Indiana mill installed a Container-Copeland process for the elimination of black liquor generated by some pulping processes at the cost of a million dollars. The sale of a salt-cake by-product from this new process reduced the net operating costs. The waste materials which industry is discarding into the air, water, or ground are potential raw materials for one or more industries analogous to the cylinder paper mill business. Several of the 92 major pollution control projects initiated by Container Corporation of America since 1960 have either shown actual profit or a potential for profit; many have increased the total profit picture of a given facility by curbing the outlay for temporary control. These 92 projects do not include systems which have been installed to increase plant efficiency as well as to serve as anti-pollution devices, such as boilers which reclaim chemicals which are otherwise lost as waste. But recovery boilers and similar systems should be looked upon as early steps in the direction of turning a problem into a profit.

6183 APTIC NUMBER 15872

Akhmedov, R. K.
HYGIENIC SIGNIFICANCE OF METAPHOS AS AN ATMOSPHERIC POLLUTANT. Gigiena i Sanit., no. 10:10-15, 1968. 4 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C. CFSTI: JPRS 48138

Air pollution by 'metaphos' (O,O-dimethyl-O-(4-nitrophenyl) thiophosphate was studied after this insecticide was used to treat fields in Uzbek SSR. Fields of 7.41 and 12.35 acres were sprayed with a 30% metaphos emulsion; total of 126 air samples were taken. Taking meteorological factors into consideration, it was concluded that the sanitary protection zone for a 7.41 acre field should be at least 2460 ft, and for a 12.35 acre field, the zone should be at least 3272 feet. The subthreshold concentration of metaphos was determined by the most sensitive method. The recommended maximum single dose permissible in the atmosphere was 0.008 mg/cu m. The effect of metaphos on animals was also determined in longer experiments. Antagonistic muscle chronaxy, cholinesterase activity in the blood, coproporphyrin, and 17-ketosteroid excretion in the urine were determined. Internal organs were also submitted for pathohistological and histochemical examination. Metaphos concentrations of 0.008 mg/cu m did not induce any morphological changes in the organs of the experimental animals when compared to the control group. The concentration of 0.008 mg/cu m was recommended as the maximum permissible mean 24-hour concentration.

6184 APTIC NUMBER 14939

Burton, David J., Vernon F. Rose, and Jeremiah Lynch
STANDARDIZING THE TECHNIQUE FOR EVALUATING THE ENVIRONMENT. Trans. Am. Governmental Ind. Hygienists Conf., 31st, Denver, Colo., 1969, p. 87-100. 12 refs.

A precise, objective technique is introduced for standardizing the evaluation of a complex environment. Called the Intensive Single-Hazard Source Survey, the technique is suited to studies or surveys where the following conditions exist: (1) electronic data processing and statistical techniques are available, (2) a large population is to be surveyed, (3) many factors affect each evaluation, and (4) the surveyors have varied degrees of experience and education. Its applications include city- or state-wide surveys of occupational health hazards. The method is helpful where little or no current information is available and a single hazard or a single type of operation is to be studied. Results provide health information for planning, enable recommendations to be made to individual establishments, and point to control techniques. The standard technique consists of extensive presurvey planning, establishing priorities, determining standards, eliminating subjective items, and adopting statistical tests and computer methods. Evaluations obtained with the technique compare favorably with evaluations reported by trained industrial hygienists. City- or state-wide surveys using the technique can determine priorities for industrial hygiene action involving individual establishments. Large 'walk-through' surveys can also be undertaken. In the latter, each establishment must be evaluated in terms of every other establishment or in terms of predetermined standards.

6185 APTIC NUMBER 14842

Chapoux, P.
POLLUTION OF THE AIR BY AUTOMOBILES. EVOLUTION OF THE FORMULATION OF THE RULES OF THE EUROPEAN PLAN. COMPARISON OF LIMITS ANTICIPATED IN EUROPE AND THE U. S. A. (La pollution de l'air par les automobiles. Evolution de la reglementation sur le plan europeen. Comparaison des limites prevues en Europe et aux U. S. A.). Text in French. Pollut. Atmos. (Paris), 11(Special):24-47, Feb. 1969.

U. S. Federal Government measurements in 1970 of emissions from automobiles on a standard U. S. run will be calculated from a given formula. In European practice, measurements are made on a European standard run. A U. S. value for carbon monoxide of 23 gm/mile is equivalent to 124 gm/mile in European calculations; a U. S. hydrocarbon figure of 2.3 gm/mile corresponds to the European 5.52 gm/mile. Germany, Italy, France, and Sweden have together proposed limits for emissions varying linearly with I, the vehicular mass in kg. The best linear fit of exhaust volume in the European run is: Vol(liters) equals 1140 + 2.9 I. The limits for prototype cars in a standard run are 48.48 + .07576 I (in grams) for carbon monoxide, and 6 + 0.003 I (in grams), for hydrocarbons. For production control, the limits are 20% higher for CO and 30% higher for hydrocarbons. Means for satisfying these requirements, especially for cars with cylinders of less than 819 cc cm, are not yet available. Proposed techniques include electronic fuel injection, carburetor adaptation for town driving, and two-performance carburetion. Richness should be kept low in deceleration and idling, and ignition delayed. Man-Air-Ox catalysis is generally considered too expensive for application. Future research work is expected to be on design of cylinders, wall temperature, internal turbulence, spark gaps, high frequency discharges, valves, and exhaust. Oxides of nitrogen must be considered but are less dangerous in Europe than in the U. S. for climatic reasons. Increasing European and U. S. cooperation is anticipated.

6186 APTIC NUMBER 14634

Dmitriyev, M. T.
APPLIED ASPECTS OF THE RADIATION CHEMISTRY OF A NITROGEN-OXYGEN SYSTEM. (Prikladnyye voprosy radiatsionnoy khimii sistemy azot-kislorod). Text in Russian. Zh. Prikl. Khim., 41(5):973-982, May 1968. 21 refs.

Relationships were derived for determining the number of ions formed per unit time and the steady-state concentration of ions and electrons for a known radiation dose in air. It was established that concentrations of ozone occurring in normal air are produced by 25-30 r doses, and 50-60 r imparts an ozone odor to the air. Doses of about 3000 r produce the odor of nitrogen oxides. Up to 250 r, the concentration of ozone and nitrogen oxides does not reach the maximum permissible value.

Maximum permissible dose for drinking water was established at 6 Mr based on nitrate ion, or 1.2 Mr based on nitrite ion; 0.05-0.4 Mr is recommended for purification of tap water; 0.05-1.2 Mr for water under field conditions, and 1 Mr for spring water. The maximum permissible dose for ammonia is 0.4 Mr. Maximum permissible doses for foodstuffs are as follows: liquids-1.2 Mr, moist foods-11 Mr, frozen foods-15 Mr, dry concentrates-95 Mr.

6187 APTIC NUMBER 15682

Anders, Karl Ludwig and Peter Peklo
QUANTITATIVE COMPARISON OF EMISSION SOURCES WITH THE AID OF A CHARACTERISTIC PARAMETER. (Qualitativer Vergleich von Abgasquellen mit Hilfe einer Kennziffer). Text in German. Chem. Tech. (Berlin), 21(10):624-627, Oct. 1969. 7 refs.

The factors which determine the extent of damage caused by an emission source include the pollutant quantity leaving the emission source per unit time, the toxicity of the pollutant, the dispersion, the effective stack height, the average wind speed, and the turbulence parameter (which depends on the climatic conditions). The simplest method for determining characteristic parameter is comparison of the emission concentration of a source with a fixed maximum allowable immission concentration (MAC). This parameter does not take into account however the area affected by the immission. Thus a characteristic parameter is based on the assumption that the toxic effect of an emission source is characterized by the area F within which the MAC is exceeded and by the magnitude of the average excess. The toxic effect F equals Ff where f equals Kd/Ko. (Using derivations by Rosanquet and Pearson, Kd stands for the average immission concentration over the area and Ko is the toxicity limit, which equals the 24-hour MAC of a certain substance.) A numerical example is given in which the toxic effect of four sources are compared.

6188 APTIC NUMBER 15336

Feldstein, Milton
AIR POLLUTION: BAY AREA. Clin. Toxicol., 2(3):307-317, Sept. 1969.

A review of air pollution problems in the San Francisco area is followed by a discussion of emission standards established by the Bay Area Pollution Control District and the duties of the State Air Resources Board. Areawide pollution problems are the reduction in visibility caused primarily by submicron particulate matter and the photochemical smog, whose primary effects are eye irritation, plant damage, and visibility reduction that is caused by photochemical reaction between nitrogen oxides and organic compounds. Emission of solid materials is controlled by two types of standards, one limiting the opacity of smoke to Ringelmann 2 and another permitting no more than 0.3 grains of solid material per cu ft of gas to be emitted from certain industrial operations and no more than 0.2 grains per cu ft from commercial incinerators. While sulfur oxide emissions are controlled by setting maximum stack emissions limits, industrial sources must also monitor ground-level concentrations. Other regulations limit the emission of photochemically reactive olefins and aromatic compounds from industrial sources. Control of automobile emissions is under the Air Resources Board, which is currently developing air quality standards for 11 air basins in California. State emission standards are given for the years 1966 to 1974, and the tons per day of pollutant emissions in the Bay Area are listed according to their sources.

6189 APTIC NUMBER 14475

Huenigen, Edmund and Wolfgang Prietsch
ON THE PROBLEM OF LIMITING EMISSION OF TOXICANTS BY MOTOR VEHICLES IN EUROPE. (Zum Problem der Begrenzung der Schadstoffemission bei Kraftfahrzeugen in Europa). Text in German. Motortech. Z. (Stuttgart), 30(7):256-259, July 1969. 24 refs.

Maximum allowable emission concentrations in exhaust from motor vehicles in Europe are presently being worked out by an organization of the United Nations, the European Economic Commission. It has been suggested that the MAC values be determined by the 'European driving cycle exhaust gas test' (EFA). Maximum allowable concentrations in the atmosphere have been set by individual European countries. A table compares the values set by the German Democratic Republic, the German Federal Republic, and Russia and shows that the limits are far more stringent in the GDR. The toxicological importance of carbon monoxide, hydrocarbons, and nitrogen oxides in each country will form the basis for working out uniform European limits. Based on the MAC for CO and on the premise that the MAC values should correspond to the toxicological importance of the pollutants, the MAC ratio for CO, hydrocarbons, and nitrogen oxides is 1:1.9:0.1. As measurements show, at present only CO emissions need to be limited. The other toxicants will not be limited until more measurements have brought detailed information concerning the relationship between emissions and air pollution. Limitations of CO emissions during idling is urgently needed.

6190 APTIC NUMBER 15608

Japan Association of Industrial Hygiene, Tokyo
ADVICE ON THE PERMISSIBLE CONCENTRATION OF POLLUTANTS (1969). (Kyoyo noio nado no kankoku (1969)). Text in Japanese. Sangyo Igaku (J. Ind. Health), 11(6):16-22, June 20, 1969.

A permissible concentration of a pollutant is the maximum daily concentration at which a worker can tolerate exposure to the harmful influence of the pollutant. The permissible concentration of each pollutant should be determined by its physical and chemical characteristics and by the way in which it invades the human body. The constitution of the worker, physical difficulty of the work, temperature, ultraviolet or radioactive radiation, and atmospheric pressure within the work room should also be considered in the practical application of the permissible concentration. The individual names of pollutants and their permissible concentrations are given in a table. The measurement of dusts whose Stokes particle diameters are less than

5 microns is also described. The measurement was performed at a height of 1 to 1.5 m above the work room floor, and the mean dust concentration from several portions of the room was used. The following machines were used in this measurement: an electric dust collector, an impinger or high-volume filter-system dust collector, and a filter paper dust meter or tyndallometer for small air currents. The particles of less than 5 microns were measured by a chemical balance. Permissible levels of noise and heat are also discussed.

6191 APTIC NUMBER 15751

Kagan, Yu. S.
THE USE OF THE CUMULATION COEFFICIENT IN CHOOSING MARGIN VALUES TO JUSTIFY THE MAXIMUM PERMISSIBLE CONCENTRATION OF SUBSTANCES. (Ob ispol'zovanii koeffitsiyenta kumulyatsii dlya vybora velichiny koeffitsiyenta zapasa pri obosnovanii predel'no dopustimykh kontsentratsiy veshchestv). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 7:15-18, 1969. 3 refs.

Marginal values, adopted in passing from the threshold concentration of substances in a chronic test to the maximum allowable concentration in the atmosphere of a production area, were contrasted against those with cumulation coefficients. A close connection between marginal values and cumulation coefficients was found with a correlation factor of 0.60. The possibility of using cumulation coefficients for an objective choice of the marginal value was discussed. Weak cumulation (coefficient over 5) corresponds with a low marginal value (2-10); medium cumulation (3-5) corresponds to a marginal value of 10-30; highly marked cumulation (1-3) corresponds to a marginal value of 30-100; and supercumulation (below 1) corresponds to a marginal value over 100. (Author summary modified)

6192 APTIC NUMBER 15609

DATA OF ENVIRONMENTAL PRINCIPLES CONCERNING SULFUR OXIDES. (Yuo-sankabutsu ni kakaru kankyo kijun setsumei shiryo). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(3):206-208, 1969.

Interpretations of the Japanese laws concerning air pollution by sulfur oxides are presented. The maximum allowable concentrations (MAC) (0.1 ppm for one hour and 0.05 ppm for one day) were determined for sulfur oxides. The daily MAC values and the rate of occurrence of symptoms in patients with chronic bronchitis were 0.10 to 0.15 ppm and 25%, respectively, in London; 0.17 to 0.20 ppm and 22% in New York and Philadelphia; 0.1 ppm and 10% in Osaka and Tokyo; and 0.03 ppm and 2% in agricultural areas in Japan. Air pollution caused by the combination of sulfur oxides with suspended or falling dust should also be considered. Severely polluted areas where pollutant concentration is above 0.30 ppm most of the time were requested to establish programs for environmental improvement over a 10-yr period, and to this end, intermediate desirable sulfur oxide levels were established. The intermediate values for the next five years varied from 0.25 to 0.10 ppm, according to the present severity of air pollution. The methods for improvement also differed among regions and industries. The MAC and intermediate ideal values in the areas (Chiba, Mizushima, or Yashima) where new industries are being established were also determined as 0.25 ppm/hr.

6193 APTIC NUMBER 14602

Latsky, C. P.
AIR POLLUTION. Certificated Engr., Suppl, The Arthur Mallett Memorial Lectures, no. 17:189-199, Aug. 1967. 24 refs.

Reasons for controlling atmospheric pollution include preservation of human health, agricultural crops, animals and inanimate matter, and guarding the safety of transport. The sources from which pollution arises are reviewed and mention is made of the types of substances emitted. The effects of climate on pollution concentrations and on the results of pollution are mentioned, as well as effects due to altitude. Estimates are given of the quantities of pollutants emitted in the Republic of South Africa. The role of the engineer in applying legal controls to the production of pollution is considered, with particular reference to combustion appliances and their installation and to the use of adequate chimney heights. The paper reviews the types of measurement of pollutants which are normally carried out as an aid to control (routine, specific, and stack sampling). It also attempts to show that air pollution can, in fact, be controlled, but that the cost of so doing must be borne by the entire community. The six distinct approaches upon which preventive legal measures are based are discussed, and the Atmospheric Pollution Prevention Act is outlined in its various major parts. Several appendices cover further details of smoke control by municipalities and the actual wording of the Standard Smoke Control Regulations approved by the Minister of Health, plus the names and addresses of information sources. (Author abstract modified)

6194 APTIC NUMBER 14663

McKee, Herbert C.
WHY A GENERAL STANDARD FOR PARTICULATES? Preprint, Am. Chem. Soc., Washington, D. C., 22p., 1968. 24 refs. (Presented at the Symposium on Air Quality Standards - The Technical Significance, 156th National Meeting, Am. Chem. Soc., Atlantic City, N. J., Sept. 12, 1968.)

This paper is concerned with ambient air quality standards for total inert particulates, i.e., particulates which contain no readily identifiable toxic or highly reactive constituents. Such standards are necessary, because dust and other particulates cause adverse effects which are independent of unique characteristics such as toxicity or reactivity. Criteria for two effects are of primary importance: (1) reduction of visibility and (2) soiling or nuisance effects. If these aspects are controlled, health damage, corrosion, or vegetation damage should not occur. An acceptable ambient air standard is 150 micrograms/cu m, since visibility at this level is seldom less than three miles. However, no single standard can automatically

cover any and all circumstances. To relate measured values to nuisance complaints, sampling data should be obtained for short periods during the episodes causing complaints. The threshold for nuisance effects is approximately 200 to 250 micrograms/cu m, assuming that dust levels remain in this range for a day or two. Most existing standards are reasonable in terms of soiling and visibility effects. Where differentiation is made on the basis of land use, established levels are usually less than 124 micrograms/cu m; even in the least restrictive industrial areas, most standards call for less than 200 micrograms/cu m. Where no differentiation is made on the basis of land use, ambient air standards are usually 150 to 175 micrograms/cu m. These standards provide incentives to improve air quality that are compatible with existing technology.

6195 APTIC NUMBER 13716

Meyer, Robert
WHAT'S AHEAD FOR CAR CLINICS/. Traffic Safety, 67(5):10-12, May 1967.

Scattered throughout the United States are more than 100 auto diagnostic centers that may be the forerunners of the state motor vehicle inspection facility of tomorrow. In addition to traditional tests on brakes and lights, these centers probe the ignition system of a car and analyze the fuel system. Electronic checks are made on sparkplugs, alternator, distributor, carburetor, coil, voltage regulator, battery, and fuel pump. The test equipment at a typical center includes the dynamometer which, by means of a set of rollers mounted in the floor, enables a car to be run in treadmill fashion at highway speeds. The dynamometer permits testing of transmission, ignition, and carburetion in a way that cannot be done without power on the wheels. While the systematic organization of the latest testing devices is a step forward in auto safety, three improvements are needed in the centers: (1) better training for technicians; (2) a new set of standards for vehicles based on age and mileage rather than on new car specifications; and (3) faster computerized testing methods that will cut in half the 45 minutes inspection now takes.

6196 APTIC NUMBER 15179

Mills, Kenneth D., H. S. Ford, R. C. Mascom, and R. D. Henderson
1970 FEDERAL DIESEL SMOKE STANDARDS. Diesel Gas Turbine Progr., 35(11):35-37, Nov. 1969.

Various aspects of the 1970 Federal Diesel Engine Smoke Standards for new engines are discussed by this Society of Automotive Engineers panel with emphasis on durability test schedules, federal exhaust smoke certification procedures, and the complexities of the federal smoke cycle. The point is made that smoke test procedures must be developed which simulate actual operating conditions for exhaust smoke production. These will include determination of the effect of extended high-load operations on smoke levels in each diesel engine family. Knowledge of the effect could lead to a future revision in federal test procedures. It is concluded that the smokiest representatives of naturally aspirated, turbocharged, two or four cycle, and cylinder engines are properly evaluated in the durability tests, whose severity is considerably greater than average. Test conditions assure that injection pressures, peak firing pressures, and combustion gas temperatures are close to the maximum possible throughout the test. The federal smoke cycle is also a stringent but reasonable evaluation of characteristics of smoke from all types of engines. It limits the smoke from both naturally aspirated and turbocharged engines, with tests suggesting that the smoke density of the former is greatest during the lug-down mode and that of the latter greatest during the acceleration mode. Once in service, new engines are subject to state controls. It is hoped that in the future, state standards will be uniform and correlated with federal standards.

6197 APTIC NUMBER 15520

Public Health Service, Washington, D. C., National Air Pollution Control Administration
AIR QUALITY CRITERIA FOR PARTICULATE MATTER. NAPCA Publ. AP-49, 211p., Jan 1969. 888 refs.

In accordance with the Air Quality Act of 1967, this publication was issued to assist the States in developing air quality standards. The document focuses on total particulate matter of the kind normally measured by high-volume and paper-tape sampling methods and by dustfall collection. It considers the effects of particulate matter in conjunction with some gaseous materials, such as sulfur dioxide, where important synergistic effects are observed. No attempt is made to establish dose-response relationships for specific particulate pollutants. Methods of measuring the effects of particulate matter on meteorological conditions, atmospheric visibility, and materials are documented, as is the resulting economic loss. The effects of particulate matter are further considered as they relate to vegetation damage. Public awareness of air pollution and the role of particulate matter in odor problems are assessed. Toxicological effects of particulate matter and epidemiological data for man and animals are surveyed.

6198 APTIC NUMBER 15676

Sanotsky, V. V.
WAYS AND MEANS OF DEVISING EXPRESS METHODS FOR SETTING MAXIMUM PERMISSIBLE CONCENTRATIONS OF NOXIOUS SUBSTANCES IN THE ATMOSPHERE WITHIN PRODUCTION AREAS. (Puti razrabotki uskorennykh metodov ustanovleniya predel'no dopustimykh kontsentratsiy vrednykh veshchestv v vozdukhe rabochey zony.) Text in Russian. Gigiena Truda i Prof. Zabolevaniya, no. 7:4-7, 1969. 16 refs.

Methods to quickly establish maximum allowable concentrations (MAC) were discussed. Methods included the determination of MAC for new substances on the basis of physical and chemical properties correlated with the MAC for the compounds, the verification of MAC for new substances by determining the relationship between their chemical structure and biological action, and the justification of MAC for new substances by determining the relationship between the parameters of acute

poisoning and the MAC level. A fourth method is the determination of MAC for new substances on the basis of chronic poisoning. From previously found chronic limits (of toxicity), it was possible to determine changes in some organs and in the nervous and endocrine systems in a short-term subacute experiment. After exposure, the organs and systems returned to normal. Thyroid changes from iodine 131 exposure were one of the first to return to normal.

6199 APTIC NUMBER 13490

Smith, Ralph G.
THE TECHNICAL SIGNIFICANCE OF AIP. Environ. Sci. Technol., 3(7):628-638, July 1969.

In the reverse of usual procedure, imposition of emission standards for carbon monoxide has preceded the publication of air quality criteria or standards. The Federal Government will issue such criteria soon, basing maximum permissible levels on public health considerations. However, the literature contains little information concerning the effects of breathing air containing less than 50 ppm CO. Two recommended physiological studies would concern the rate of CO uptake and release by the blood and the effects of CO on specialized nervous system functions at carboxyhemoglobin levels below 5% (saturation level). The level of 30 ppm for 8 hrs adopted by California is too high; since air containing 30 ppm is dirty, a lower concentration is preferable, perhaps 15 ppm. Discussion by R. Weinstock: The California standard is conservative and was established to protect the most sensitive population group, i.e. people with emphysema, anemia or heart disease. Dirty air cannot be attributed to carbon monoxide, which is odorless, tasteless, and colorless. Carbon monoxide evinces no biological symptoms until high carboxyhemoglobin levels are reached. Discussion by G. M. Wilkening: There is no justification on the basis of health effects alone, to support a more stringent level than 30 ppm for an 8 hr period. Also, the synergistic effects of carbon monoxide with other agents such as sulfur dioxide and nitrogen oxides should be determined.

6200 APTIC NUMBER 14687

Walker, A. B.
OPERATING PRINCIPLES OF AIR POLLUTION CONTROL EQUIPMENT. GUIDELINES FOR THEIR APPLICATION. American Institute of Chemical Engineers, New York, N. Y., American Inst. of Mining, Metallurgical and Petroleum Engineers (AIME), New York, N. Y., American Society of Civil Engineers, New York, American Society of Heating, Refrigerating and Air Conditioning Engineers, New York, American Society of Mechanical Engineers, New York, and American Society for Testing and Materials, Philadelphia, Pa., Proc. MECAR Symp., Design and Operation for Air Pollution Control, New York, N. Y., 1968, p. 49-78.

Equipment for emission control at the source comprises two categories: particulates and gases and odors. Equipment for control of particulates falls into four generic types: filters (principally fabric), electrostatic precipitators, dry inertial collectors (principally cyclones), and wet scrubbers. For control of gases and odors, there are wet absorbers (scrubbers and packed towers), dry adsorbers, and thermal or catalytic incinerators. In cases of complex emissions, these devices can be combined. The basic operating principles of these devices are examined and the critical factors in their application are identified. The latter involves certain basic data requirements. As an absolute minimum, the following must be defined: the volumetric flow rate of gases; the gas temperature, pressure, and humidity; the particulate form and concentration; the particulate size distribution and specific gravity; the particulate bulk electrical resistivity (dry); the required removal efficiency; and process constraints with regard to the use of water. From these basic data, it is possible to perform an initial screening on the type of system required. This screening will define technically feasible alternate solutions. Selection of the optimum equipment requires a detailed analysis of additonal technical and economic factors, including capital investment, operating costs, and costs of capital.

6201 APTIC NUMBER 14772

Weaver, Neill K.
ATMOSPHERIC CONTAMINANTS AND STANDARDS. STATUS REPORT. J. Occupational Med., 11(9):455-461, Sept. 1969. 23 refs.

The Federal Air Quality Act of 1967 furnishes the methodology for the abatement of air pollution. Its provisions include the designation of air quality control regions and the issuance of air quality criteria and control technology documents, which will be followed by the promulgation of ambient air standards and emission standards at regional, state, and local levels. The atmospheric pollutants of current major concern are sulfur oxides, particulates, nitrogen oxides, hydrocarbons, oxidants, carbon monoxide, fluorine, and lead. Their toxic and other deleterious effects, exhibited at various concentration-time exposures, can be related to levels reached by the individual contaminants in the air of cities. While such an evaluation does not allow for possible interactions between pollutants, it appears that sulfur dioxide, oxidants, and carbon monoxide may be harmful to human health when the agents are concentrated, as in focal areas of emission or during sustained meteorologic inversions. Gains to be achieved by controlling these and other contaminants during non-peak conditions are probably derived from aesthetic, economic, and welfare benefits rather than health. Abatement procedures should eliminate rises in pollutant levels beyond the average ranges generally present in urban ambient air. (Author summary modified)

6202 APTIC NUMBER 14612

Zinn, Robert F. and Walter P. Niessen
COMMERCIAL INCINERATOR DESIGN CRITERIA. American Society of Mechanical Engineers New York Incinerator Div., Proc. Natl. Incinerator Conf., New York, 1968, p. 337-347. 1 ref. (May 5-8).

Increasing collection and disposal unit rates, compounded by increasing refuse generating rates, are leading many industries, shopping centers, and the like to attempt disposal of their own solid wastes. In many cases, resulting savings, together with the elimination of unhealthy accumulation of wastes, are sufficient to justify private disposal systems. However, upgrading the capabilities of these incinerators is necessary in view of projected increases in the use of plastics, metal foils, and glass as packing materials. These materials can cause failure of incinerator grates, supporting structures, and operating mechanisms. Combustion air control with suitable agitation of the residue to attain good burnout is shown to be a necessary design parameter. Thus, future designs of incinerators must avoid the use of grate systems, yet provide adequate stoking of the burning mass to obtain complete oxidation. Provisions should also be made to install burners in both primary and secondary chambers and to achieve a continuous flow of refuse and ash. If refuse is moved through the system in a plug flow manner, hot combustion products from freshly charged materials can be used to assure burnout of the ash.

LEGAL AND ADMINISTRATIVE

6203 APTIC NUMBER 15612

CLEANING OUR ENVIRONMENT: THE CHEMICAL BASIS FOR ACTION. American Chemical Society, Washington, D. C., Committee on Chemistry and Public Affairs, Subcommittee on Environmental Improvement., Washington, D. C., American Chemical Society, 249p. 520 refs.

The current status of the science and technology of environmental improvement is analyzed, and 73 recommendations are made for accelerating the development and use of that technology. While not concerned with the management and nonscientific aspects of environmental control, the document is addressed primarily to legislators, administrators, and others who must deal with pollution problems. The role of chemistry, chemical engineering, and related disciplines in long-term control programs is stressed, as is the need for federal involvement in environmental programs. Control legislation must be national in scale, and the federal government must support research and development programs, the collection of environmental surveillance data, and the construction of air pollution abatement facilities. It is recognized that the environmental system is made up of a bewildering number of subsystems that are only distantly interdependent. For this reason, environmental problems are not amenable to sweeping solutions. Several problem areas emerge as explicit themes of the report. One is the inadequacy of knowledge of how living things are affected by long-term, low-level exposure to pollutants. A second is the inadequacy of knowledge of the effects of pollutants on the ecology. A third is the inadequacy of current methods of monitoring, controlling, and studying the environment and related phenomena. Topics not covered by the report include thermal pollution, pollution by radioactive materials, and pollution by aircraft engine exhaust.

6204 APTIC NUMBER 14337

Baccanari, Samuel
LEHIGH VALLEY AIR POLLUTION CONTROL DISTRICT. (Appendix A to: Effect of Area on Air Pollution Control Programs.) Pennsylvania State Univ., University Park, Center for Air Environment Studies, WAPCA Grant AP-00458, Final Progress Rept., 9p., Nov. 30, 1968.

The Lehigh Valley Air Pollution Control District, an interjurisdictional air pollution control program established in 1957 under ordinances enacted by the municipalities of Northampton and Nazareth, is described. The communities, located in the southeastern portion of Pennsylvania, comprise the Lehigh Valley cement belt, which extends for 25 miles and includes about 75 square miles. Prior to establishment of the control district, residents had tolerated a long-standing condition of excessive dustfall from the cement industry. The entry into the district of additional communities has caused the district to expand its scope to include control of other pollution sources as well. The program has two full-time employees: a director who, as a professional engineer, enforces the individual municipal ordinances, and a secretary. In each municipality there are citizen air pollution control boards of five members appointed by the elected representatives. Public funds are obtained by levying service charges on participating governments according to an established formula. The program has been judged effective on the basis of both significant expenditures by industrial plants for air pollution control equipment and a steady decline in the annual dustfall in the area under the District's jurisdiction. Data is included on annual dustfall survey averages and on cement plants in the District. Administration of the program emphasizes persuasion and conciliation, with enforcement powers, for the most part, held in reserve.

6205 APTIC NUMBER 14808

Barthel, Christopher F., Jr.
AIR POLLUTION PROBLEMS IN KANSAS. Trans. Kansas Acad. Sci., 70(3, Suppl.):11-18, 1967. (Presented at the Kansas Environmental Pollution Symposium, Kansas Academy of Science,

The major air pollution problems of Kansas stem from the generally favorable position of the state as far as air resources are concerned. The problems are a lack of awareness on the part of a majority of Kansans of the growing hazards of air pollution and a lack of knowledge of air pollution and its control on the part of many persons in positions of authority. Kansas has much to gain by positively approaching the problems and readying itself for national air quality standards. The air resources of some communities would not meet national air quality standards, and these communities would be faced with control measures. For existing industries, the development and installation of adequate control devices and procedures on a long-term basis is far more economical than such development and installation on a crash basis. New industries are springing up all the time. Planning for air pollution control at the source, while planning for an entire industrial operation, is generally the most economical means of effecting adequate control at lowest cost. A reasonable statewide awareness of the problems, along with development and industrial participation, of reasonable control measures would minimize the severe government-industry conflicts on air pollution control. It is concluded that proper authorities at all levels should widely publicize their intention to maintain the air quality through a reasonable program of air resources conservation and management. State legislation should be enacted to chart the course for reasonable state and community programs. A little time and effort should be devoted by the people to familiarize themselves with air pollution problems in Kansas, to learn proper conservation and management of air resources in the state.

6206 APTIC NUMBER 15605

Berindan, Cornelia
INTER-RELATION BETWEEN AIR POLLUTION AND OPEN SPACES, AS A PRINCIPLE FOR THE PROTECTION OF INDUSTRIAL URBAN CENTRES. (Interrelation pollution atmospherique et espaces verts en tant que principe protecteur des villes industrielles). Text in French. Pollut. Atmos. (Paris), 11(43):143-153. July-Sept. 1969. 59 refs.

The use of vegetation for the protection of residential areas from air pollutants emitted by neighboring industrial plants is reviewed. A table listing the principal (smog and its constituents), secondary (aerosols and oxides) and other gaseous aerosol, or particulate pollutants is given. Pertinent research concerns the effect of polluted air on vegetation, and the effect of vegetation on atmospheric air, particularly on polluted air. A table of phytotoxic effects of industrially polluted air is provided with respect to 267 subspecies of plants, as rated in Romania, Poland, USSR, Germany, Holland, Bulgaria, Austria, and Sweden. The capacity of retaining airborne dust by 12 species of trees is also tabulated. The capacity of plants to retain pollutant gases is discussed. The aerodynamic effects of tree plantings and their role in dust retention and as wind deflectors are pointed out. Illustrations of the use of green belts for protection of residential areas from polluted air based on studies made in the United States, Holland, Czechoslovakia, and Rumania are given. General principles which govern the layout of protective zones of vegetation in industrial urban centers are provided.

6207 APTIC NUMBER 14344

Clemson, Barry
CYBERNETICS AND ORGANIZATION THEORY. A QUANTITATIVE METRIC FOR INFORMATION FLOWS. (Appendix 5 to: Effect of Area on Air Pollution Control Programs.) Pennsylvania State Univ., University Park, Center for Air Environment Studies, NAPCA Grant AP-00458, Final Progress Rept., 17p., Nov. 30, 1968. 3 refs.

Information sets were constructed which allow measurement of all routine information involved in the operations of an air pollution control program. The agency on which the theoretical work is based is the Allentown-Bethlehem Bi-City Health Department. Bethlehem has a major pollution problem but no control program at all, while Allentown has a small-to-moderate problem and a very active and effective control program; therefore the study focused upon Allentown. The information sets were constructed by interviewing the air pollution control officer, observing his daily routine, and reading his files on 68 separate air pollution emitters. Of the many sets that were constructed and are enumerated, examples are given on three: city departments, public health activities, and kind of pollutants; these are grouped on subdivided levels. It is judged that a computer system will be required to handle the clerical work involved in using these sets to calculate information flows. Examples of their use are given, and the importance of the fact that the information metric can handle unforeseen messages is emphasized. It is concluded that rigorous testing of the proposed metric would entail an extended period of sampling communication flows.

6208 APTIC NUMBER 15558

Cross, Frank L., Jr. and Roger W. Ross
CURRENT STATUS OF AIR POLLUTION CONTROL REGULATIONS FOR ASPHALT PLANTS AND SIMILAR DRYING OPERATIONS. Preprint, Public Health Service, Durham, N. C., National Air Pollution Control Administration, 12p., Sept. 1969. 5 refs.

Current regulations for controlling emissions from asphalt plants are reported for 38 states and 6 local agencies. Nine states, and one local control agency, have specific regulations for asphalt plants. These regulations include particulate matter and smoke, but not odors or other pollutants. Four of the states base their regulations on the amount of pollution emitted per 1000 pounds of flue gas discharged; two others base theirs on a process weight table, and require a specific collection efficiency for control equipment; the remaining use a concentration standard and/or a buffer zone. The remaining 29 states, and five local control agencies, have regulations applicable to all industrial processes and apply them to asphalt plants. Most of these states use process weight tables for control of particulate matter. Many also require that visible emissions not exceed Number 2 on the Ringelmann Scale or equivalent opacity. Nine states employ a standard for odor control. Although most of the odor regulations are general in nature, one state stipulates the use of a scentometer for odor measurement.

6209 APTIC NUMBER 14797

Petrie, J. P.
ESTABLISHMENT OF TOLERABLE LIMITS FOR EMISSION AND IN THE ENVIRONMENT. (L'etablissement des limites tolerables a l'emission et dans l'environnement). Text in French. Pollut. Atmos. (Paris), 11(Special):53-61, Feb. 1969.

A review of the establishment of emission limits from the point of view of the Council of Europe is presented. The author points out the difficulty of uniform standards of pollution measurement, including such problems as different pollutants in different areas, particle size, variation in atmospheric conditions, and variation in methods, particularly among countries. He reviews present legislation for the United Kingdom, the Federal German Republic, Belgium, Denmark, Italy, Switzerland, The Netherlands, and Czechoslovakia, with a more detailed study of regulations for France and Paris. The importance of good communication between biologists and hygienists on the one hand and industry on the other is stressed.

6210 APTIC NUMBER 14386

DeWald, Dale
THE IMPACT OF PROGRAM GRANTS ON AIR POLLUTION CONTROL IN PHILADELPHIA. (Appendix 7 to: Effect of Area on Air Pollution Control Programs.) Pennsylvania State Univ., University Park, Center for Air Environment Studies, NAPCA Grant AP-00458, Final Progress Rept., 21p., Nov. 30, 1968. 3 refs.

The effect of Federal grants between 1966 and 1967 to Philadelphia on the activity level and administration of the city's air pollution control program, is discussed. These federal funds, granted under the Clean Air Act, in 1967 amounted to $223,312. During the first year of the grant, almost half of the available funds were used to purchase necessary equipment for air quality

measurements and compliance inspections. There has been a net increase of 26 positions in the city's Air Pollution Control Section since the grant started, although 11 openings were not yet filled at the time of writing, personnel structure shifted to compliance inspection because of the category of positions that were filled. These expenditures were determined by local section decisions rather than by any federal intervention. During the period under study, annual compliance actions rose more than 600%, from about 550 actions in 1966 to about 3200 that were expected in 1967. Detailed federal accounting requirements caused a major administrative impact in budgeting and fiscal operations. The requirement that the local agency submit a 'Workable Program' in order to be eligible for grants ensured that a systematic approach on the local level, including basic data collection and analysis of needs, was followed. It is concluded that, contrary to the findings of previous studies of the administrative effects of federal grants to local agencies, federal requirements are not severe and would not influence the city in accepting or rejecting future grants which carry similar requirements.

6211 APTIC NUMBER 15878

Ellerbe, David P., David H. Scott, and David B. Smith
SURVEY OF LEGAL AND ADMINISTRATIVE AUTHORITY AFFECTING AIR, WATER AND SOLID WASTE PLANNING. PART ONE. Palm Beach County, Fla., Area Planning Board, HUD Proj. Fla. P-65, 71p., April 1969. 7 refs.

This report is the first part of a comprehensive background study for all of Palm Beach County. It is essentially an inventory of the authority, activity, and programs of municipal, county, state, and federal agencies having jurisdiction over air pollution, water supply, sewerage, and solid wastes. The activities are examined for duplication, compatability, and hiatuses of responsibility. The report is oriented toward changes that may be needed for implementation of pollution control plans. Recommendations for change of legal or administrative authority are not included. It is concluded that there are sufficient agencies and administrative authorities to conduct comprehensive planning activities in the county. No major hiatuses of responsibility are noted.

6212 APTIC NUMBER 15757

Esseson, Lawrence
AIR POLLUTION CONTROL IN THE CITY OF NEW YORK. Asian Med. J., 11(12):1-4, Dec. 1968.

The formation of a Regional Air Pollution Warning System for New Jersey, New York State, and New York City is reviewed. Created in 1961 by state and city air pollution control boards and health departments, with the cooperation of the United States Public Health Service, the system is controlled by the Interstate Sanitation Commission. When the commision issues an air pollution alert on the advice of the weather bureau, cooperating agencies undertake intensive air pollutant measurements. Simultaneously, the mayor of New York and the governors of New York and New Jersey can restrict the burning of fuel, control automobile traffic, and close municipal incinerators. Activities of the warning system are exemplified by the air pollution crisis of Thursday, November 24, 1966 when, following an inversion of several days duration, maximum hourly levels were 1.02 ppm for sulfur dioxide, 35.0 ppm for carbon monoxide, and 8.2 cohs for smoke shade. Fuel companies were asked to burn natural gas, incinerators were shut down, and space heating in apartment houses and commercial buildings was curtailed. As a result, the inversion began to break up on Friday, with pollutant levels dropping accordingly as diffusion set in.

6213 APTIC NUMBER 15924

Galeano, Sergio F. and Frederick A. Adams
A MANAGEMENT GUIDE FOR THE EVALUATION OF POLLUTION CONTROL PROGRAMS. Tappi, 52(12):2331-2335, Dec. 1969. (Presented at the Water and Air Conference of the Technical Association of the Pulp and Paper Industry, Jacksonville, Fla., April 28-30, 1969.)

A review of the fragmented but unified aspects of environmental control activities, and the evaluation of concepts on pollution control in the last two decades, suggest the need for intensified planning of control programs. Evolving technology, capital appropriations, and levels of enforcement are the key factors. The ultimate solution is given by a system analysis approach. A measurement unit was developed which incorporates quantitatively all the major pollutants, relates them to tolerance levels, and expresses them as a single unit. This unit, the Pollutional Load Unit (PLU), permits the construction of charts which in effect are the histograms of environmental conditions of a mill at any time. Proposed programs and their effects are thus easily compared. The PLU can be used to evaluate beneficial effects of a single control step. The program can be used up to five years. To use the program longer is unwise because of the rapid promulgation of air and water criteria and subsequent standards, and the developing state of the art in abatement systems and equipment. It is also important to remain flexible in budgeting these programs. The primary reason is that the programs established must be regularly evaluated and changes in emphasis made as warranted.

6214 APTIC NUMBER 14784

REGULATION FOR ENFORCEMENT OF LAW 615 OF JULY 13, 1966, AGAINST AIR POLLUTION IN THE FIELD OF HEAT INSTALLATIONS. APPENDICES. (Regolamento per l'esecuzione della legge 13 luglio 1966, n. 615, recante provvedimenti contro l'inquinamento atmosferico limitatamente al settore degli impianti termici. Appendici). Text in Italian. Ing. Sanit., 16(2):126-135, March-April 1968.

This is one installment of presidential decree no. 1288 of October 24, 1967, and consists of seven 'appendices' indicated below by numbers in parentheses. It includes: (1) technical requirements for plant expansions or newly built plants; (2) samples of report forms for fuel and (2a) smoke samples; (3) a graph of allowable solid particle content in smoke as a function of chimney height; weight determination instructions for solid particle content in smoke, a description with four

drawings of sampling apparatus for collecting (a) solid particles and (b) sulfur compounds in smoke, plus (4) description and drawing of a bubble-cap absorber for dissolving gases; (5) determination of total moisture, (6) volatile substances, and (7) total sulfur in solid coke and coal fuels. Requirements are specified for tube connections, condensers, thermometers, manometers, procedures for gathering and analyzing samples, and equations and formulas for expressing the findings.

6215 APTIC NUMBER 15688

CONTROL OF AIR POLLUTION. Intern. Digest Health Legislation, 20(3):418-419, 1969.

The principal provisions of a regulation under an air pollution control act for Ontario are presented. Terms defined include fuel burning equipment, odor, and smoke. Sources of air pollution exempt from governmental regulation and fuel burning equipment for comfort heating, on-site construction equipment for maintenance and construction of public roads, domestic incinerators, equipment for food preparation in restaurants, bakeries, dry-cleaners, personal residential equipment, and equipment for seeding, harvesting, fertilizing, or pest and weed control on agricultural lands. The regulation also states that equipment may not be operated which do not comply with minimum air quality standards or emit disagreeable odors. A smoke density chart is provided for which determines the allowable smoke density for a given period of time or for specific operations. The regulation prohibits the emission of pollutants from incinerators and waste disposal units and the operation of municipal incinerators other than at the prescribed hours. Fuel burning equipment for the burning of solid fuel in suspension may not be operates without the use of dust separating equipment. Maximum allowable concentrations for use in assessing air quality are also prescribed.

6216 APTIC NUMBER 15694

Japan Ministry of Health and Welfare, Tokyo
SPECIAL TREATMENT LAW FOR THE INJURED FROM PUBLIC NUISANCE WITH REFERENCES APPENDED. (Kogai ni kakaru kenkohigai no kyusai ni kansuru tokubetsu sochiho oyobi sankoshiryo). Text in Japanese. Kankocho Kogaisemmon Shiryo (Public Nuisance Gaz.), 4(4):23-35, July 1969.

The Special Treatment Law provides medical aid to those people suffering from diseases due to air or water pollution. The legal procedure includes applying for the medical grant. When an application is made, the governor concerned decides if the disease is caused by air or water pollution, based on advice given by the Authorization Committee of Public Nuisance. When a decision is made, the patient is authorized to be given financial aid. However, when the amount of his, his wife's, or his supportor's income tax exceeds a prescribed amount, the grant is not given. Special types of diseases, specified by the Ministry of Health and Welfare, are not subject to this exception. Patients who are physically handicapped or who have needed nursing before onset of the disease are permitted to ask for nursing. A series of laws and regulations which are in effect and closely related to this Relief Law are listed, including the Fundamental Law of Public Nuisance Control, Health Insurance Law, National Health Insurance Law, Livelihood Protection Law, Civil Law, Income Tax Law, and Public Nuisance Control Committee Law.

6217 APTIC NUMBER 14931

BASIC POLICY FOR AIR POLLUTION CONTROL PLAN - YOKKAICHI, CHIBA, ICHIHARA, AND MIZUSHIMA AREAS. (Kogaiboshi keikaku no kihon hoshin - Mieken Yokkaichi, Chibaken, Chiba-Ichihara, Okayamaken Mizushima no hakuchiiki). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(6):53-61, June 1969.

To test the practicability of the Air Pollution Control Plan proposed by the Air Pollution Control Council, the Japanese Prime Minister has directed the governors of the Yokkaichi, Chiba, Ichihara, and Mizushima areas to apply the plan. The plan's directives seem positive and constructive and are expected to establish new cooperation between the federal and local governments. Each of the test areas shows promise of heavy industrial development and has rapid population expansion. The goal of the plan is the reduction of pollutants to the set limits by 1975.

6218 APTIC NUMBER 15098

TERMS OF AIR POLLUTION CONTROL PLANNED FOR 1969. (Showa 44 nendo ni oite kojiyo to suru kogaiboshi ni kansuru shisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):715-726, Sept. 1969.

Each item in the Pollution Control Law is briefly discussed. Chapter 1 consists of plans for a fundamental policy concerning pollution control and contains a definition of environmental standards. Chapter 2 is the Public Pollution Control Law; it designates polluted areas based on emission inventories and sets permissible automobile exhausts at 2.5% of the total emissions. Chapter 3 concerns water pollution and consists of regulations for water quality preservation, industrial waste water control, control of oil pollution in the ocean, agricultural irrigation water pollution control, drainage system improvement, and mining waste water control. Chapter 4 considers control of traffic, railroad, and airplane noise. Chapter 5 discusses a monitoring system for ground level pollution. Chapter 6 designates research activities of the Science and Technical Agency, the Dept. of Agriculture and Forestry, and the Ministries of Public Welfare, Construction, International Trade and Industry, and Labor. Chapter 7 designates funds for enforcement of the law, funds for a public pollution control committee, and special tax reductions. Chapter 8 outlines the establishment of a relief system.

6219 APTIC NUMBER 14934

RECORD OF THE 61ST SENATE SPECIAL COMMITTEE MEETING ON INDUSTRIAL POLLUTION CONTROL. FINANCING PUBLIC NUISANCE

MEASURES AND THE RESPONSIBILITY OF INDUSTRY. (Dai 61 kai kokkai sangiin sangyo kogai taisaku tokubetsu iinkai no kiroku. Kogai no kyusaihi to kigyosekinin no kankei). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):729-732, Sept. 1969.

A discussion of the Transaction Bill of Industrial Pollution Conflict and the Special Treatment Bill of Health Suffered by Industrial Pollution was presented. The main point of discussion was how the medical expenses for the injured party should be paid and where the responsibility should be placed. The Transaction Bill is not endowed with the right of adjudication. This means it is effective only when a certain condition is fullfilled, i.e., when the violator and the cause are clear beyond doubt. It is, however, extremely difficult to discover the dependence of effect on cause in the case of industrial pollution. Therefore, the violator would not willingly accept a judgement. In addition, the injured party must act for himself to be compensated. In the Special Bill, the violator is not clearly defined, and compensation is made indirectly. For instance, the violator deposits money with the Industrial Pollution Control Commission and the Commission pays the injured party. This procedure would tend to hide the actual violator. It was concluded that neither Bill would provide effective compensation for the injured party.

6220 APTIC NUMBER 18960

Leduc, Edgar C.
AIR POLLUTION CONTROL IN PENNSYLVANIA. In: Effect of Area on Air Pollution Control Programs. Pennsylvania State Univ., University Park, Center for Air Environment Studies, 16p., Nov. 30, 1968. 3 refs.

Air pollution control programs on all levels in Pennsylvania are presented. In 1960, under the Air Pollution Control Act, an Air Pollution Commission was set up in the Department of Health. Powers of the Commission include adopting rules and regulations for air pollution control, hearing complaints, establishing maximum limits on pollutant emission, and issuing orders for compliance. The Commission has the power to designate regional associations consisting of a representative of each county in the region. These associations review proposed regulations of the Commission, suggest regulations, and are the primary level for the consideration of complaints. The Division of Air Pollution directs the activities of approximately sixty highly trained specialists, maintains a number of laboratories and is putting into operation a computerized telemetric air pollution surveillance network. The Air Pollution Commission is considering the creation of air basins having relatively autonomous enforcement programs. Areas to be chosen will have a substantial air pollution problem and share a common pollution concentration. Few local governments have adequate air pollution air pollution or smoke abatement programs, although local programs are necessary, especially where air pollution nuisances are temporary and intermittent, and where the population wants higher air standards than those provided by the state's minimum. Preventive measures by local governments could do much to protect local air resources. Both the federal and state government will give technical advice and assistance to local and regional programs, and a system of federal grants-in-aid is available to states and local governments for program planning and maintenance. In Pennsylvania, it will be possible to have state regional, state air basin, local regional, and local governmental programs operating in the same areas.

6221 APTIC NUMBER 18832

Leduc, E. C., T. Gartner, J. Sacco, and R. Fistler
MANPOWER POLICIES IN SELECTED AIR POLLUTION CONTROL AGENCIES.
J. Air Pollution Control Assoc., 18(4):211-214, April 1968.
6 refs.

Selected personnel practices of air pollution control agencies in three urban areas of various sizes and in a state agency were examined. It was found that all of the agencies, except the state agency, were operating with about 25% of their authorized positions vacant. In each jurisdiction, the main organizational groups involved in personnel administration were the civil service board, the chief executive's office, and the operating agency. In all jurisdictions, there is a trend toward decentralization of the personnel function. Recruiting effort varied widely in the four jurisdictions. The recruiting effort of 'Medium City' was sporadic, unplanned, and based on immediate needs. No attempt was made to estimate need; continual contact was not maintained with manpower sources. The recruiting programs of the 'Metro City' and 'Urban County' were well-conceived. Needs were estimated and a wide variety of recruiting techniques were used. The state agency's recruiting program was the most sophisticated. Personnel needs were forecasted by the agency, a wide variety of techniques were employed, and continual contact was maintained with employment sources. At a time when air pollution control agencies are gearing themselves for major efforts, the following needs to be strongly emphasized; the tasks of the leaders of air pollution control programs should include efforts to promote good personnel programs and policies, and high-quality personnel are required. Recruitment, classification, and compensation plans cannot be of high quality unless the public bodies responsible for setting the goals of personnel policy and the conditions of employment are conscious of the necessity for rational and workable personnel systems. Based on the findings that are reported, it was concluded that such systems are not sufficiently developed.

6222 APTIC NUMBER 18999

Leduc, Edgar C.
POLITICS OF RESOURCE USE IN LOCAL GOVERNMENT POLICY AND PROGRAMS. Appendix 9. Effect of Area on Air Pollution Control Programs. Pennsylvania State Univ., University Park, Pa., Center for Air Environment Studies, NAPCA Grant AP-00458, Final Progress Report., 15p., Nov. 30, 1968. 38 refs.

The methodological aspects of investigating the political determinants of resource use on a local level are discussed. Previous studies indicated that it is the owners or managers of the commercial, industrial, or banking firms of a community, rather than government officials, who make the important

decisions affecting use of local resources; however, this trend is changing as increasing population numbers, density, and expectations bring about greater government involvement. Land use planning and capital improvements budgeting, both important tools for the management of resources by local governments, are reviewed in terms of the ways in which they are affected by politics. It is concluded that land use planning is too isolated from the political process because of the common administrative arrangement whereby the planning staff is responsible to a lay commission that is appointed rather than elected, and thus is not responsive to the demands of local citizens. Capital program budgeting is too involved with governmental processes and with the need to include features insuring reelection of politicians to produce budgets compatible with comprehensive conservation plans. The effects of the democratic political process on conservation values, and particularly on efforts to control air and water pollution, are briefly discussed.

6224 APTIC NUMBER 14708

Legner, M.
ABOUT THE ACTIVITY OF THE STATE TECHNICAL INSPECTION OF AIR CONSERVATION. (Cinnost Statni technicke inspekce ochrany ovzdusi). Text in Czech. Ochrana Ovzdusi, no. 2:17-19, 1969.

Measures against air pollution, according to Act No. 35/1967, are characterized by the imposition of penalties in cases of air pollution, by increased administration power of regional air control authorities, and by increased responsibility of the Ministry of Forestry and Water Resources in the field of air conservation. The State Technical Inspection of Air Conservation is under the direction of the Ministry. Its function is to control sources of pollutants, measure emissions, provide advisory services, impose methods for restricting the emission of noxious substances, and to work closely with health authorities. It has the right to initiate research and development programs. One of its major objectives is the systemized control of emissions from such sources as power stations, heat plants, industrial boiler houses, fuels with a high ash content, chemical plants, metallurgical processes, and concrete works. Through the State Technical Inspection of Air Conservation, the Ministry of Forestry and Water Resources is collaborating with industries on new plant design and applying rigid technical tests to existing plants. Inspection of control equipment is the responsibility of district inspection committees, which have the right to fine both plants and individuals responsible for pollution. It is hoped that better coordination can be realized between district authorities and the national committee. Such coordination is needed to develop combustion tests for the objective control and determination of pollutants escaping from boiler houses.

6224 APTIC NUMBER 14941

Matsuda, Toshio
PRESENT STATUS OF AIR POLLUTION CONTROLS RELATED TO THE COMBUSTION OF HEAVY OIL. (Juyu no nensho ni kankeishita taikiosen boshiho no genkyo). Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 21(9):33-38, Sept. 1969.

All the regulations proclaimed by laws, departmental ordinances, and announcements related to air pollution controls are explained. The Fundamental Anti-Air Pollution Law specifies detrimental elements such as air pollution, water pollution, noise, vibrations, offensive odors, and certain ground substances. The Air Pollution Control Law forms a part of the Fundamental Law. It stipulates that any facilities or plants which produce stack smokes must follow the regulations. The Air Pollution Control Law prescribes the permissible limits of sulfur oxides, soot, dust, and automobile emission. It also directs industrial plants to keep records of the quantity of stack waste gas and its density. Formulas are presented for calculating the permissible level of sulfur oxides and for determining the sulfur content of heavy oils. It is recommended that the Ministries of Transportation and Public Welfare decide jointly on the allowable levels of automotive emissions. Carbon monoxide is generally required to be below 3 vol-%. Five areas of future sulfur oxide control are outlined, but control techniques are not yet practically feasible.

6225 APTIC NUMBER 15516

Nelson, H. W., P. F. Schuler, M. J. Shilhan, and R. B. Engdahl
STUDY OF THE IDENTIFICATION AND ASSESSMENT OF POTENTIAL MARKETS FOR CHARS FROM COAL PROCESSING SYSTEMS. Battelle Memorial Inst., Columbus, Ohio, Columbus Labs., Contract 14-01-0001-1190, Sept. 68, 78p., 1969. 29 refs.
CFSTI: PB 182 966

The potential markets for chars derived from coal-processing conversion systems were identified and assessed. The chars showed considerable variations in their contents of ash, sulfur, and volatile matter. The importance of concern for air pollution is reflected in the choice of fuels used in power plants and the means adopted to alleviate the emission of sulfur oxides from the stack. Awareness of this problem led to research on methods of desulfurizing char. A method was suggested involving the contacting of a mixture of char and dolomite with hydrogen in a rotary bed. The dolomite is regenerated and elemental sulfur is recovered as a by-product. Plants having access to medium- or high-sulfur coals will be forced to employ means of removing the sulfur oxide content of combustion gases before they are discharged to the atmosphere. Injection of limestone into the furnace followed by wet scrubbing is promising but costly. Calculations showed that a desulfurized char has a premium value when compared with generating costs using coal with the added costs of removing sulfur oxides from the stack gases. If the desulfurization process is shown to bear costs, there would be a large market in the Midwest and East for the desulfurized char. In combination with its lack of moisture and hydrogen, the desulfurized char should show savings in generating costs and thus be a preferred fuel. Because of high contents of ash and sulfur and the relatively fine size of the char, which leads to excessive stack losses, it was concluded that there is little prospect of finding a market for char in the manufacture of calcium carbide. An assessment of the potential usefulness of char as a component of a blend of coals used in coke ovens for the

production of metallurgical coke showed that the high sulfur and ash contents would make them unacceptable for use in blends.

6226 APTIC NUMBER 15097

Oba, Hideki
MORE RESTRICTIONS ARE PROPOSED ON AUTO-EXHAUST CONTROL. (Jidosha haikigasukisei no kongo no mondai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(9):671-676, Sept. 1969. 7 refs.

Defects in the present automobile emission regulations and in the technical aspects of emission control are discussed and compared with the U. S. program. The Japanese limit of 2.5% of emissions is based on performance tests of prototype cars. Under actual driving conditions, harmful emissions are probably greater than 2.5% of the entire exhaust. Therefore, both testing and control methods should be improved to meet realistic requirements. Improved highway construction and restriction of city traffic are considered only minor to the amelioration of the situation. In the U. S., technical and legal developments have resulted in a revision of test methods for automobile emissions in 1970 model cars. Previous tests based on percentage of emissions have been replaced by tests of total harmful emissions. It is suggested that Japan also base its standards on total emissions and restrict other gases besides carbon monoxide.

6227 APTIC NUMBER 10826

Olds, F. C.
AIR POLLUTION CONTROL: GOOD INTENTIONS IN RESEARCH OF DIRECTION. Power Eng., 73(9):28-35, Sept. 1969.

Forms which ultimate pollution control programs may take are discussed. Air quality control regions are being established and consist of small areas surrounding urban or metropolitan centers. Boundaries are being drawn on the basis of meteorology, topography, urban-industrial development, and jurisdiction. Each region will include neighboring communities that are affected by a common pollution problem. Each state will have at least one control region which brings all of its communities into the federal program. Plans must be developed and executed to implement the air quality standards. Industries are inclined to abide by legal directives to abate pollution, but major roadblocks in politics and government prevent orderly progress. There are effective and reliable means for removing oxides of sulfur and particulate matter. Available equipment can bring owners into compliance with anticipated emission standards. It was further judged that the systems will take no more than the usual debugging at startup and will perform as reliably as other highly critical plant units. Additional, equally attractive systems are well along in development. The problem comes when the owner tries to decide what type of abatement system to install and when to install it. It is possible that steps taken now and present equipment will both be rendered obsolete by upcoming laws. It was concluded that the single most important matter is for the authorities to declare a fixed set of principles by which management may be guided.

6228 APTIC NUMBER 15237

Paganini, Otto
THE CONTROL OF AIR POLLUTION IN TEXAS. Texas Business Rev., 43(3): 6p., March 1969. 3 refs.

Because the state has an abundance of combustible gas fuels, Texas does not have the degree of air pollution found in solid and liquid fuel burning areas of the country. However, photochemical smog is beginning to develop in major population centers. An example is the Houston-Harris County area, where pollutant buildup occurs during low-level temperature inversions from October through March. The Fort Worth-Tarrant County and Dallas City-County areas are also experiencing some pollution problems. Local air pollution control programs, as well as state programs directed by the Texas Air Control Board, are maintaining surveillance in these areas and working to reduce emissions from major sources such as cotton gins, smelters, foundries, petroleum refineries, and petrochemical industry, refuse burning at public disposal sites, and automobile exhausts. Activities of local programs include the operation of high-volume and 'effect-package' types of air sampling stations which collect samples on a weekly, biweekly, and monthly basis. The Air Control Board, established by the Clean Air Act of Texas (1965), is empowered to establish air quality criteria and to determine levels and emission limits for pollutants. The Board must support local governments in all suits against violators of emission standards.

6229 APTIC NUMBER 15926

AIR POLLUTION CODES - HERE'S LATEST PICTURE. Roads Streets, 113(1):104, 106-107, Jan. 1970. 5 refs.

Regulations currently in effect that are used by air pollution control agencies to control emissions from asphalt batch plants were described. Nine of 38 states have specific regulations for asphalt plants. These regulations include particulate matter and smoke, but do not include odors or other pollutants. The regulations of four states and one local agency are based on the amount of pollution emitted per 1000 lb of flue gas discharged from the stack. Two of the states base their regulations on a process weight table, and require a specified collection efficiency of control equipment. Still another state bases its regulations on a concentration standard and a buffer zone. And one state uses only a buffer zone to control emissions. The other 29 states and five local control programs have regulations applicable to all industrial processes and apply them to asphalt plants. Most of these states use process weight tables for the control of particulate matter. Many also have regulations that visible emissions must not exceed No. 2 on the Ringlemann Scale or equivalent opacity. Nine of the states employ a standard for odor control. Although most of the regulations are written in general terms, one state stipulates the use of a scentometer for odor measurements.

6230 APTIC NUMBER 14691

Sacco, John
STATE AIR POLLUTION CONTROL ADMINISTRATION IN THE COMMONWEALTH OF PENNSYLVANIA. APPENDIX 4 TO: EFFECT OF AREA ON AIR POLLUTION CONTROL PROGRAMS. Pennsylvania State Univ., University Park, Center for Air Environment Studies, NAPCA Grant AP-00458, Final Progress Rept., 18p., Nov. 30, 1968. 2 refs.

The development and administration of the Pennsylvania state air pollution control program is described. Air pollution control was a function of local units until 1948. From 1948-1959, air pollution control activities were operated under the General Health Law which issued abatement orders where public health was endangered. An air pollution control bill in 1955 brought two issues forward, the location of the policy-making power, and the control policy. In 1960, the Air Pollution Control Law was passed. The organizational structure consisted of the Air Pollution Commission oriented toward economic considerations, the Regional Association oriented toward local needs, and the Department of Health oriented toward technical considerations. The abatement process consists of receiving, investigating, and registering the complaints and recommending action and orders for abatement. The case input of the abatement process was described in terms of number of cases and type of cases which increased each year due to greater publicity, more personnel, and increased public discontent. The case output was measured in terms of abatement lag, which increased, and time length, which decreased. Policy, legal basis, manpower, location of decision-making power and increased demand by the public accounted for the recorded lag and abatement time length. Change occurred in the abatement process in the due process requirements, the number of regulations, the manpower complement, and the hearing procedure. Air pollution survey input is steady, but poor technology and scarce resources hindered the speed and quality of the survey output. The permit process consists of getting information about construction of potential sources, evaluating the information, and deciding whether to accept the application. Budgetary levels are increasing but cannot keep pace with public demand for clean air due to lack of a strong clientele group. The content of the public relations program was evaluated as having a conservative orientation due to the neutrality of public bureaucracies and the compromising effect of the orientations of the commission and department.

6231 APTIC NUMBER 14385

Sacco, John F. and Edgar C. Leduc
AN ANALYSIS OF THE EFFECT OF SOCIAL, ECONOMIC AND POLITICAL FACTORS ON STATE AIR POLLUTION EXPENDITURES. (Appendix 1 to: Effect of Area on Air Pollution Control Programs.) Pennsylvania State Univ., University Park, Center for Air Environment Studies, NAPCA Grant AP-00458, Final Progress Rept., 19p., Nov. 30, 1968. 21 refs.

A research model was established to determine the relative importance of certain socio-economic and political variables on air pollution policy of the states, as measured by expenditures for pollution control. The socio-economic variables used were levels of urbanization, industrialization, income and air pollution potential, measured by the number of employees in selected industries. Political factors included partisanship, malapportionment, voter participation, and local control effort. The methodology and analytical techniques are described, and the resulting statistical findings are given. Results for 1963 showed that 18 states spent more for air pollution; the average expenditure was 0.6 cents per capita. Each of the 18 were characterized by a combination of a severe pollution problem and sufficient resources to devote to air pollution control. All four measures of social-economic development were found to relate to expenditure patterns, while among the political variables, only apportionment seemed related, and then only to levels of spending. By 1967, some changes were noted. The connection between economic factors and spending behavior was weaker; states at all stages of economic development were participating financially in pollution control. A difference, though not a statistically significant one, continued to exist in the levels of expenditure, with the economically more advanced states spending more than the less developed states. The suggested causes of this increased response are federal legislation leading to program development and financial aid, increasing magnitude of the physical problem, and internal efforts by the state governments.

6232 APTIC NUMBER 15691

BASIC PLAN FOR PUBLIC NUISANCE CONTROL IN IBARAGI PREFECTURE. (Ibaragiken kogai boshi kihon keikaku). Text in Japanese. (Ind. Public Nuisance), 5(7):389-398, 1969.

A fundamental plan for the control of public nuisances is presented which conforms to the Public Nuisance Control Regulation in Ibaragi prefecture. A basic attitude towards public nuisance control and policies which promote the extermination of major sources and factors of public nuisance are given. The purpose of this plan is to preserve the living environment by bringing under control unpleasant odors, sewage or waste water, noise, vibration, stack smoke, dust, and gas. Land use control, enforcement of water range control, and adjustment and preservation of the living environment constitute actual measures which can be taken. The development and practice of control techniques are being researched. A survey is recommended of the existing pollution severity with respect to classification and localization. A collective control system consisting of all these divisional activities is to be established to make a final decision. Collection of all the available ideas or countermeasures on the national scale and transmission of these to local bodies is strongly encouraged.

6233 APTIC NUMBER 15646

Shimizu, Tatsuo
PRESENT STATUS AND FUTURE PROSPECT ON MOTOR VEHICLE EMISSION CONTROL. (Jidisha haishutsugasu kisei no genjo to taisaku). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(4):269-272, 1969.

An interpretation is presented of a newly established law concerning the control of all kinds of gases emitted by automobiles (the 3rd project of the law on the air pollution control). The concentration of carbon monoxide is an index according to this law for determining the severity of air pollution by emissions from automobiles which use only petroleum as fuel. The volume of CO emission in a new automobile should be less than 2.5% when the car runs in a definite driving cycle. The concentration of emitted CO gas is measured during each of four phases of driving procedure (idling, acceleration, constant-speed driving and deceleration) by the use of a non-scattered-type infrared analyzer. A used car has to be inspected with respect to the emission of the gas. As an example, data from the measurement of CO concentration at an intersection in Tokyo was also shown before and after the improvement of the intersection.

6234 APTIC NUMBER 15393

Solberg, Erling D.
GREENBELT ZONING--AN EVALUATION. Preprint, Northeast Illinois Planning Commission, Chicago, 13p., 1965. 30 refs. (Presented at the Northeastern Illinois Planning Commission Seminar on Air Resource Management, Chicago, Jan. 11, 1965.)

Greenbelt zoning districts (exclusive-type agricultural zoning districts) are subject to severe economic, tax, and political pressures which frequently call for premature rezoning. These pressures are most intense on the urban fringe, especially in states of rapid population growth. The location of subdivisions, shopping centers, and industries among farms creates an increase in land values; prices rise far above the value of the land for farming. Rising land prices produce successive tax repercussions. Assessed valuations are increased to reflect prevailing market prices of the land rather than its value in its current use; therefore, farmland tax assessments are based on prospective values for subdivisions or other non-farm uses rather than on its value for farming. Costs are furthermore increased from rapidly growing urban fringes which require outlays for new public facilities and services within a few years. Higher tax levies on higher assessed valuations tend to multiply the tax bill, often forcing the farmer to sell. Death and inheritance taxes can foreclose further use of a farm for agriculture. Several states have adopted laws that provide for preferential assessment of farmland. Gradations are observed in rural-zoning 'enabling laws' in the manner and degree of direction exercised by the states over the character of rural zoning regulations, ranging from merely granting permissive zoning authority to state-enacted zoning ordinances. Under the first four types of enabling laws, the final work remains with the local unit of government, which may decline to zone. The final decision under the remaining three laws is made at the state level. Zoning-created industrial greenbelts will be subject to many of the same pressures as are zoned agricultural greenbelts.

6235 APTIC NUMBER 15689

Stumph, Terry L. and Robert L. Duprey
TRENDS IN AIR POLLUTION CONTROL REGULATIONS. Environ. Control Management, 138(8):42-44, Dec. 1969. 2 refs.

Process equipment regulations are discussed. Emission standards for sulfur dioxide are relatively unrefined, consisting of specified effluent concentration based on measured performance of well-designed and well-operated contact sulfuric acid plants. Sulfur oxide emission standards leave much to be desired because of their origination from studies on a single source category, questionable applicability to other major sources and limitation of pollutant concentration rather than mass-emission rate and they are subject to dilution. Process weight regulations which restrict total particulate matter emission rates from industrial processes as a function of the process weight rate are insensitive to certain industries. This has led to the development of specialized weight regulations for asphalt plants in West Virginia and ferrous foundries in New York. New York and Pennsylvania developed regulations in which the emission limits vary with the pollution potential of the source. This type of regulation appears readily adaptable to sources; the uncontrolled emission rates are easily determined. This regulation presents difficulty when applied to industrial operations discharging particulate matter. Potential emission rate would be determined by sampling the uncontrolled effluent gases and measuring collector efficiency, or by assigning potential emission rates through the use of pre-established emission factors. There is likely to be a need for generalized regulations for a variety of sources, but there may also be a need for tailored regulations which apply to a single source category. Regulations might be based on process-weight rate or potential emission rate. The rate would depend upon the relative ease with which measurements could be made and the nature of the source.

6236 APTIC NUMBER 14685

Teller, Azriel
THE USE OF LINEAR PROGRAMMING TO ESTIMATE THE COST OF SOME ALTERNATIVE AIR POLLUTION ABATEMENT POLICIES. International Business Machines Corp., White Plains, N. Y., Data Processing Division, Proc. IBM Scientific Computing Symp. on Water and Air Resource Management, Yorktown Heights, N. Y., Oct. 23-25, 1967, p. 345-353. 5 refs.

In determining the level of abatement which minimizes for society the cost of pollution damage and the cost of pollution control, the choice is between constant abatement and forecasting abatement. Within each, a number of approaches may be utilized to determine the necessary degree and cost of abatement. Two possible approaches are equiproportional abatement and selective abatement. Equiproportional abatement assumes that all sources will reduce their emissions in the same proportion as the desired reduction in air pollution concentrations. Its proponents neglect the reality that a source which emits X% of emissions may be responsible for less than, or more than, X% of the concentration. Equiproportional abatement is exemplified by city-wide or industry-wide emission standards, which have two important consequences: (1) some sources do not control their emissions sufficiently while others have too much control, and (2) industries have no incentive

to relocate. Selective abatement assumes that the cost of a unit reduction of emissions is not the same for all sources and that the effect on a particular receptor of emissions is not the same for all sources. The application of linear programming to relative cost estimates of sulfur dioxide abatement in Nashville indicates that selective abatement is cheaper than equiproportional abatement and that costs decrease drastically with accurate air pollution forecasting. With few exceptions, selective abatement is the more efficient method of reducing air pollution. The exceptions are private residential units, small incinerators, backyard burning of refuse, and automobiles. For these sources, the cost of administering selective abatement would be exorbitant.

6237 APTIC NUMBER 15388

Texas Air Control Board, Austin
REPORT FOR CONSULTATION ON THE METROPOLITAN HOUSTON-GALVESTON INTRASTATE AIR QUALITY CONTROL REGION (TEXAS). Washington, National Air Pollution Control Administration, 1969, 27p. 5 refs.

A proposal is presented in accordance with the Air Quality Act of 1967 to abate air pollution in the metropolitan Houston-Galveston area comprising the following counties: Harris, Galveston, Brazoria, Fort Bend, Waller, Montgomery, Chambers, and Liberty. Regional boundary designations include evaluations of topography, meteorology, emission inventory, air quality analysis, suspended particulate air levels, sulfur oxide levels, and carbon monoxide levels. Urban factors with respect to population and industry are also taken into consideration. The major sources of emission were recorded as transportation, combustion fiels, refuse disposal, and industrial processes, and were located in Harris, Galveston, Brazoria, and Fort Bend counties. The proposed area satisfies the following criteria for determining area size: A region should be self-contained with respect to air pollution sources and receptors; boundaries should be designed to meet not only present but also future conditions; and boundaries should be compatible with and even foster unified and cooperative governmental administration of the air resources throughout the region.

6238 APTIC NUMBER 14398

Vaillant, G.
AIR POLLUTION PREVENTION IN INDUSTRY. TECHNICAL AND ECONOMIC ASPECTS. (La lutte contre la pollution atmospherique dans l'industrie. Aspects technique et financier). Text in French. Chem. Ind. (Paris), 100(8):1244-1249, Nov. 1968.

Technical solutions exist for treating waste gases, but the funds required for their research and development are beyond the capabilities of most industries. Furthermore, there is no one solution for a given category of emission problems. Each case has its unique aspects and a suitable method for treating gases cannot be extrapolated from those used elsewhere. Because of the costs involved, the fight against air pollution cannot be the affair of industry alone. Joint action must be undertaken by public powers and special organizations at national, regional, departmental, and local levels. These groups will determine reasonable and acceptable emission levels, arrived at in agreement with industry, and methods to obtain the desired results. However, it is reasonable to assume that specialized firms will take the initiative in researching processes for treating gases. Industrial research should be directed toward improved manufacturing methods. Industry cannot concentrate all its efforts on the treatment of residual gases. Application of standards and selected treatment methods will depend on financial aid in the form of government credits and subsidies. It is hoped that the government can realize a return on its investments through the sale of patents and equipment on the foreign market.

6239 APTIC NUMBER 14810

Wise, Harold F.
POLLUTION AND PLANNING DEVICES FOR GUIDING THE PLANNING PROGRESS TOWARD THE RESOLUTION OF ENVIRONMENTAL PROBLEMS. Trans. Kansas Acad. Sci., 70(3, Suppl.):19-28, 1967. (Presented at the Kansas Environmental Pollution Symposium, Kansas Academy of Science, Topeka, Kansas, March 3, 1967.)

A planning process for the resolution of environmental problems is discussed. Complications which characterize the development of appropriate policies and programs at the state level are outlined. Pollution knows no political boundaries. The control of air and water pollution is complicated by incomplete understanding of the effects of pollution and of the natural processes by which the streams purify themselves and concentrations of polluted air are dispersed. Also, the pollution of air and water resources are related to almost every aspect of environmental, economic, and human development. To meet the problems of preserving and improving air and water quality, a process of planning is proposed which would serve to formulate a development policy, design and schedule programs and apply resources to implement policies, evaluate effectiveness of development policies and their implementing programs, and provide adequate coordination and communication among the issues of multiple levels of government. On the highest level is the Comprehensive Development Policies Plan, a broad statement of strategy and direction to achieve desired goals and objectives. The second building block is a series of Functional Plans directed toward the development of more specific strategies, the delineation of short term objectives, and the establishment and coordination of detailed courses of action for selected functional development areas. The Program Plan, the third step, delineates and describes specific operating policies and objectives for each program undertaken by an operating agency, and relates these to the policies and objectives of the appropriate functional plan. It also constitutes the basic information input necessary for the formulation of functional plans. The fourth block in the system is called a Biennial Development Program which would be prepared on a forward two-to-six year basis and would establish short-term development goals and programmatic objectives. The fifth part of the process would be the Regional Development Plan, prepared at the regional level and reflective of plans, policies,

and programs undertaken at that level. This planning process, if properly applied, should assist public officials with policy and program responsibilities in making decisions associated with environmental pollution.

6240 APTIC NUMBER 15567

Creer, Ralph Nuttall
SOCIAL PSYCHOLOGICAL FACTORS INVOLVED IN THE PERCEPTION OF AIR POLLUTION AS AN ENVIRONMENTAL HEALTH PROBLEM. Utah Univ., Salt Lake City, Dept. of Sociology, Thesis (MS), Aug. 1968, 45p. 53 refs.

A survey was made to determine if high economic dependence on a source of air pollution creates such dissonance and strain in an individual that he perceives a less serious air pollution problem than individuals with little or no economic dependence on the source. The data comes from a random sample of residents of American Fork, Utah, where a high proportion of the population is employed by a steel plant. If an individual was employed by the plant, he was considered to have high economic dependence; if not, he was considered to have low economic dependence. To avoid biasing the findings, age, sex, and education were controlled. The data were analyzed first in terms of simple proportions and then by a unique method of the chi square test for a significant association, an extension of the Mantel-Haenszel chi square procedure. The findings indicate that respondents with low economic dependence are slightly more prone to recognize or be aware of a pollution problem than are those with high economic dependence. Age also appears to have a significant influence on the ability to recognize the seriousness of a pollution problem, with females 48 years or younger the most perceptive. On the other hand, level of education has little influence on the perception of an environmental health problem.

6241 APTIC NUMBER 10805

Johnson, K. L.
CITIZEN COMPLAINTS OF AIR POLLUTION IN NORTHEASTERN ILLINOIS. Preprint. Public Health Service, Cincinnati, Ohio, National Center for Air Pollution Control, 17p., 1967. (Presented at the 60th Annual Meeting of the Air Pollution Control Association, Cleveland, Ohio, June 11-16, 1967, Paper APCA 67-176.)

An examination was made of citizen complaints of air pollution registered with air pollution control agencies representing the City of Chicago, outlying Cook County, and the State of Illinois. The complaint files of the City of Chicago contained the addresses of some 9500 air pollution sources specified by complainants in complaints covering the time period from approximately 1958 to 1968. A statistical sample of these sources showed more than 70% to be of a non-industrial nature, with domestic fuel burning or incineration by neighbors most often specified. There were 1119 industrial process sources named in the Chicago files, 588 nonmanufacturing and 531 manufacturing. Fabricated metal industries, primary metal industries, chemical manufacturers, and food processing plants were cited more often than other industrial categories. Complaint sources named in complaints filed by citizens with the state of Illinois, and with Cook County, differed with those of Chicago in that industrial sources were specified more often than nonindustrial ones. The reason for this is believed to lie in the reduced residential densities and the relatively great use of pollution-free fuels in the metropolitan area outside of the City of Chicago. (Author abstract modified)

6242 APTIC NUMBER 15760

Lindvall, Thomas
THE NUISANCE EFFECTS OF AIR POLLUTANTS. (Luftföroreningars olägenhetseffekter). Text in Swedish. Nord. Hyg. Tidskr. (Stockholm), no. 3:99-115, March 1969. 11 refs.

Annoyance reactions from odorous and particulate air pollutants were regarded as medico-hygienic problems in Sweden. Legislation in Sweden permits intervention based solely upon subjective annoyance reaction to some extent. Nuisances from industrial plants are usually caused by odors and particulate matter. Complaints were reported in 78% of urban and 27% of rural communities. The medico-hygienic evaluation of nuisance from air pollution includes studies of the dose-response relationship between the pollutant in the ambient air and the extent and strength of the annoyance reaction. The description of the dose is often complicated by the fact that many odorous substances are hard to detect while they still have odor. Therefore, the concentration in the ambient air is often based upon analysis at the source combined with meteorological spreading calculations. From a statistical point of view, there is often a satisfying correlation between predicted and actual concentrations in the ambient air. The organoleptic principle of analysis of odorous emission was used more frequently during the last few years. Odor threshold determinations were successfully used in testing odor abatement equipment and in dose description around pulp mills. The frequency is calculated by which a certain concentration is exceeded at different distances from the source. The description of the dose was satisfactorily worked out by the use of standardized, sociological inquiries with special attention to certain effects of interaction, such as disguising of or differences in attitude. Response studies were undertaken in Sweden around pulp mills and oil refineries. (Author summary modified)

6243 APTIC NUMBER 10491

Ohira, M., H. Maruya, and T. Nagira
A STUDY OF AWARENESS AND OPINION OF THE RESIDENTS ABOUT PUBLIC NUISANCES IN MIZUSHIMA (NEWLY DEVELOPED INDUSTRIAL AREA). (Mizushima chiku jumin no kogai ni tsuite no ishiki tokyono chosa). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 24(1):99, April 1969.

Air pollution has been intensified in Mizushima, due to the introduction of the steel and oil industries. A survey of subjective symptoms and opinion on air pollution was conducted among 182 households in the area regarded as most polluted (called area A) and 88 households in apartments owned by one of companies regarded as a polluter in this area (area B). Complaints such as eye irritation, frequent coughing and expectoration, and malodorous air were heard more frequently at A than at B. People from area A, who once welcomed the

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introduction of industry, are much more displeased with it than people from area B, who belong to the industry. However, the former are becoming reconciled to this pollution. They do not believe that the local government or industry will control air pollution. Furthermore, they have little confidence in the ability of a civic association to eliminate public nuisances and would rather move out of the area than oppose pollution. On the other hand, people working in the offending industry pay little attention to nuisances. It is concluded that the opposition of residents to public nuisances should be supported by physicians, scientists, and other actively concerned persons.

6244 APTIC NUMBER 15096

Bassetti, P.
AIR, WATER, AND SOIL POLLUTION AFFECTING THE CITY AND PROVINCE OF MILAN. (L'inquinamento dell'aria, dell'acqua e del suolo, nei riguardi di Milano e del suo Territorio). Text in Italian. Ing. Sanit., 16(2):88-101, Jan. - Feb. 1968. 7 refs.

Air pollution derives from three principle sources: oil refining and petrochemistry (20%), home heating (60%), and motor traffic (20%). In Milan and Turin, smog in the atmosphere has reduced the lifetime of automobile finishes by 50%. Italy has only recently confronted the air pollution problem, and few Italians realize the high cost of its prevention. A company in the city of Corniglaino has spent 1.5 billion dollars for equipment to combat air pollution. Proper adjustment of home heating equipment would diminish smog by 40% and would give a 20-25% saving on fuel oil. The Italian law of July 13, 1966 divides the entire nation into two control zones: (1) communities in north central Italy with 70-300 thousand inhabitants or special air pollution problems, and insular Italian communes with populations ranging from 300,000 to one million; (2) communities of north central Italy of 300,000 or more and of southern Italy with one million or more. Factories and plants are subject to regulation when their power output is more than 30,000 kcal/hr. No limitations are made on combustible liquids and gases; petroleum distillates such as kerosene and gasoline with 10% or less sulfur; coke with 2% or less of volatile materials and 1% or less sulfur; or coal with 13% or less volatile materials and 2% or less sulfur. Wood and charcoal are prohibited. Limitations are placed on combustible fluids with more than 5 Engler degrees of viscosity at 50 C and 3% or less sulfur content. Plants must conform to these regulations by December 31, 1969. More than 75% of this article is concerned exclusively with water pollution and the establishment of a 'Po Valley Authority' to deal with water and soil pollution problems of that geographical area.

6245 APTIC NUMBER 14537

Benoliel, Jom Tob Azulay, Victoria Valli Braile, Maria Regina M. de B. Fonseca, Aloysio Ribeiro, and Jairo Rodrigues
AIR POLLUTION IN BRAZIL. (Poluicao atmosferica no Brasil). Text in Portuguese. Secretaria de Obras Publicas do Estado da Guanabara, Rio de Janeiro, Brazil, Instituto de Engenharia Sanitaria - SUPSAN, 1968, 161p. (Report to the Latin American Seminar on Air Pollution held by the Pan American Health Organization, Rio de Janeiro, Nov. 18-22, 1968.)

The largest contribution to air pollution in Brazil comes from the factories in the vicinity of large cities, followed by automobiles and solid waste. Sulfur dioxide is the most harmful gaseous pollutant; solid pollutants consist of suspended and setting particulates. A series of graphs is presented showing pollutant levels between 1967 and 1968 for various cities and areas of Brazil and the United States. (The region of Sao Paulo, a heavily industrialized area, is excluded from this study.) Meteorological factors influence air pollution and are in turn influenced by it; it is believed that pollution creates hotter and dryer climates. The Brazilian government in many instances requires that industries burn specified fuels in approved furnaces. Dumping of trash is forbidden; it must be incinerated. Legislation is being enacted to enforce changes in domestic fuel and stoves. Special furnaces have also been developed to burn leaves that give off norious gases. A government agency conducts regularly scheduled factory inspections to enforce proper function of factory equipment and air pollution control devices. In an effort to prevent development of a pollution problem while pollution is still limited, a study was made of the areas of greatest pollution in Brazil. Daily and seasonal fluctuations of pollution levels were determined, and the effect of pollution on human health was studied. Tables and graphs comparing pollution levels and/or meteorological factors in several American and Brazilian cities show how small the problem still is in Brazil.

6246 APTIC NUMBER 14479

Biersteker, Klaas
AIR POLLUTION IN THE NETHERLANDS. Tijdschr. Soc. Geneesk. (Assen), 47(3):66-70, Jan. 31, 1969. 28 refs.

In a survey conducted in 1965, all Dutch municipalities with populations above 50,000 reported experiences with air pollution. Many complaints center on local nuisances, particularly the odors caused by a potato plant in Groningen, textile industries in the eastern part of the country, spice, timber, and oil operations north of Amsterdam, and oil refineries and phosphate plants in Rotterdam. The odors are frequently a result of water pollution, indicating a connection between the two types of pollution, at least in the Netherlands. Because of the increasing concentration of population and industries in the area comprising Rotterdam, Amsterdam, and The Hague, a further increase in air pollution problems is anticipated. Tables give the standard smoke concentrations in central Rotterdam in the winter months for the years 1957 to 1968 and the 3,4-benzopyrene content at two sampling stations in Rotterdam from 1961 to 1967. Also tabulated are the distribution of Dutch municipalites according to the number of inhabitants since 1900 and the population densities of The Netherlands and other countries.

6247 APTIC NUMBER 15468

Bilous, Oleah
STUDY OF THE ECONOMICS OF A PLANT FOR THE SEPARATION OF URANIUM ISOTOPES BY GASEOUS DIFFUSION. United Nations, New York, Proc. U. N. Intern. Conf. Peaceful Uses At. Energy, 2nd, Geneva, 1958, vol. 4:422-427, (Translated from French.)

This report describes the major problems involved in the choice of a gaseous diffusion plant to be used for the separation of uranium isotopes. Since the choice depends on economic evaluations and simplicity, the problem of selection of operating pressures, barrier characteristics, alternatives for structure of the stages, and control are discussed. The total electric power required is directly proportional to the pressures via the compression ratio and indirectly via the separation coefficient. On the other hand, the capital costs are inversely proportional

to the compression ratio, as a result of the decrease in the number of stages. For plants producing small enrichment and having small capacity, the optimum compression ratio lies between about 6 and 10, the effective ratio at the barrier being less than these values due to loss of load. Different types of compressors are mentioned. Since the separations containing the barrier represent almost one-quarter of the plant investment, the properties of the barriers largely determine the necessary capital costs of a plant. Barriers are characterized by their permeability, mean pore radius, lifetime, and mechanical resistance. Various arrangements of the stages for small-scale plants are discussed; these may vary by the number of separator compartments, the rank of the stages where outputs are fed back in and the way in which the low-concentration output is fed back into the stages. Control of pressure flows in the plant's operation can speed up or slow down the response of the cascade to changes in output demand or to equipment malfunction, and permits a reduction of the fluctuations of the transported material in the cascades of the plant. It is possible to calculate in advance a program of optimum flows in the plant and to correct this problem during operation using the aerodynamic regulation of concentrations in the cascades as an adjustment parameter.

6248 APTIC NUMBER 14836

Cockrell, Charles F., Richard B. Muter, and Joseph W. Leonard
STUDY OF THE POTENTIAL FOR PROFITABLE UTILIZATION OF PULVERIZED COAL FLYASH MODIFIED BY THE ADDITION OF LIMESTONE-DOLOMITE SULFUR DIOXIDE REMOVAL ADDITIVES. West Virginia Univ., Morgantown, Coal Research Bureau, Contract PH 86-67-122, 99p., April 30, 1969. 25 refs.

The potential for profitable utilization of modified fly ash, resulting from limestone or dolomite injection, was determined by characterizing physical and chemical properties of the material, performing utilization tests, and initiating utilization studies. Chemical composition and physical characteristics are described. The utilization potential was determined by separating modified fly ash by sizing, specific gravity, magnetic, electrostatic, and surface chemical properties in attempts to concentrate usable minerals. Two developments of the study involving concentration to recover lime and melting to yield sulfur derivatives and mineral wool were linked together to form a preliminary conceptual plan for an Emission Control Minerals Complex to utilize all parts of modified fly ash. It was determined that modified fly ash had advantages over lime for acid mine drainage neutralization because of the decreased sludge settling and filtering time. However, the greater amounts of fly ash required and the transportation distances likely to be involved would greatly reduce the potential for successful implementation of this utilization scheme. Modified fly ash was of use in concrete admixtures, since the strength of concrete and lime-modified fly ash mixtures attained good compressive strengths, but other physical requirements varied. Utilization of limestone-modified fly ash in cement kilns also has potential because it could supply a portion of both the argillaceous and calcareous components. It is limited somewhat in this area because of limits on the amount of iron oxide in the resultant portland cement. Modified fly ash also has potential in soil stabilization and as a soil amendment. The lime to fly ash ratio required to stabilize most soils is readily available in modified fly ash, so that no additional lime would be required. Greenhouse studies under standard methods of application indicated that dolomite-modified fly ash, when used as a soil amendment, gave good yields of fescue at the lowest application rate of any of the fly ashes listed. (Author summary modified)

6249 APTIC NUMBER 14617

Davenport, S. J. and G. G. Morgis
AIR POLLUTION. A BIBLIOGRAPHY. Bureau of Mines Bull. 537, Washington, D. C., Government Printing Office, 1954, 448p. 3902 refs.

This bibliography, confined strictly to outdoor atmospheric pollution has been arranged according to subject, with abstracts under each subject in chronological order, arranged alphabetically by authors. The subjects include general aspects of air pollution, the nature and origin of air pollution, composition of pollutants, and effect of air pollution on health, buildings, and vegetation. Also included are methods of determining air pollution. Categories under control include general measures, mechanical aids, collection and precipitation, district heating, proper firing, smokeless fuel, smokeless heaters and furnaces, and stack control of dust and fumes. The legal aspects and cost of air pollution are also included in subject headings.

6250 APTIC NUMBER 15603

Gantcheff, Georges S.
AIR POLLUTION. SOURCES AND EFFECTS OF SULFUROUS GASES. (Pollution de l'air. Les sources et les effets des gaz sulfureux). Text in French. Ingenieur (Montreal), 55(246): 15-21, Sept. 1969. 310 refs.

A systematic review of the literature on air pollution by sulfur compounds is presented, especially with respect to hydrogen sulfide, sulfur dioxide, sulfur trioxide. The author considers in succession: gaseous fuels, liquid fuels, solid fuels, formation of sulfur oxides during combustion, sulfur compounds as air pollutants, and the effects of sulfur bearing gases on plants, animals, man, and on materials of various kinds. The bibliography with 310 entries accompanying this paper to which the author refers throughout the text has not been reproduced in the magazine for lack of space, but can be obtained upon request from the editorial office of L'Ingenieur.

6251 APTIC NUMBER 14726

Grosser, P. J.
MODERN ASPECTS OF AIR HYGIENE. (Neuere lufthygienische Aspekte). Text in German. Z. Ges. Hyg. (Berlin), 14:265-271, April 1968. 38 refs.

A critical comparison of the air pollution situation in the German Democratic Republic with other industrial countries is given. Characteristic of the power and heat production in the GDR is the high consumption of soft coal. Per capita consumption of soft coal in 1964 was 60 times as high as the world average. The mineral oil consumption rose in the last few years by 20%. The problem of rising air pollution is compounded by continued concentration of the population in industrial areas. No overall picture of the air pollution situation is presented, however, since no national measurement program is yet in existence. It is suggested that the example of Great Britain be followed, where the Warren Spring laboratory has set up 1100 measuring stations in 450 cities of all sizes, as well as in rural areas, to make smoand SO2 measurements. The GDR has the administrative personnel and the guidelines necessary for such measurements. In addition to such measurements, studies of the effects of air pollution on human health are recommended. Most important is the need for ascertaining standards.

6252 APTIC NUMBER 15528

Grossmann-Cooper, Anna
AIR POLLUTION PUBLICATIONS: A SELECTED BIBLIOGRAPHY 1955-1963. Public Health Service, Washington, D. C., Division of Air Pollution, PHS Pu-979. Washington, D. C., U. S. Government Printing Office, 1964, 178p.

This revised biography of air pollution publications by Division of Air Pollution personnel and other persons receiving Federal air pollution funds covers the years 1955 through 1963. It contains 1029 entries and supersedes PHS Publication 979 of the same title. For easy access, the bibliography is arranged in three sections: entries listed by first author, entries listed by title, and entries listed by subject matter. Author and geographic location indexes are included. There is also an alphabetical list of journal titles and their abbreviations.

6253 APTIC NUMBER 14813

Hashimoto, Michio
AIR POLLUTION CONTROL IN JAPAN. (English translation), World Health Organization, Geneva, Switzerland, WHO/AP/24.65, 9p., (date not given).

Air pollution in Japan has increased due to rapid industrial growth and the change from coal to petroleum as the source of energy. The control of SO2 in smoke and the elimination of sulfur from fuel are the most pressing problems. The control of motor vehicle exhausts will be developed within a few years in metropolitan areas such as Tokyo and Osaka. Smoke emission standards for industry were established in 1963. Since then seven smoke control areas have been designated. Standards for noxious gases, vapors, and fumes are under consideration. Loans and tax reductions are being granted to industries installing control devices. It is hoped that new industrial building sites will be compatible with air pollution control programs. Housing sites will not be constructed where maximum emission sources are concentrated. Heavy pollution from major emission sources is to be prevented by proper plant design and control equipment. Industries emitting pollutants which tend to accumulate will not be located in areas of frequent inversions. To prevent air pollution disasters no community is to be surrounded by industrial plants. Scientific research on air pollution is expanding and effective measures are being taken to combat pollution problems. Regional development projects are emphasizing local initiative and autonomy in air control planning, proper land use, citizen participation and cooperation between industries and neighboring communities.

6254 APTIC NUMBER 15229

Kaspar, J.
THE INFLUENCE OF POLLUTED LOWER ATMOSPHERE ON HUMAN HEALTH. (Vliv znecisteneho ovzdusi na lidske zdravi). Text in Czech. Ochrana Ovzdusi, 1(6):81-93, 1969.

The effects of combustion products from energy and heat plants, in addition to emissions from combustion engines in Czechoslovakia, are discussed. Harmful substances include ashes, industrial dusts, and sulfur oxides. Waste gases in residential areas are becoming more harmful as a result of increasing motorization, insufficient urban solutions to these problems, and insufficient construction of traffic routes. Other harmful substances, e.g., nitrogen oxides, hydrogen sulfide, and arsenic, also have a significant toxic influence, although they occur in small amounts. Unknown emissions from the petrochemical and synthetic industries must be identified and treated. Partial studies on the influence of polluted air have obtained different results, indicating the complexity of the problem. Heterogeneous substances in foodstuffs, the regime and mode of life, the quality of drinking water, noise, psychological factors of humans, and sociological aspects must be considered.

6255 APTIC NUMBER 15007

Lieb, J. W. and P. H. Jaffe
HOW TO EVALUATE MATERIALS FOR FILAMENT WINDING PART 2. Mater. Design. Eng., 52(2):140-143, Aug. 1960.

Ordinary test methods used for glass-reinforced plastics are insufficient to evaluate the important properties of resin systems used for filament winding. A procedure is described for predicting the behavior of resin in a filament wound structure which proceeds from simple, rapid, inexpensive screening tests on the resin system, through more involved and expensive testing of filament wound specimens, to an evaluation of the performance of reduced scale or full size parts. Initial screening tests are carried out where wet winding is planned. When resin system viscosity exceeds 10,000 cps in less than 120 min, the system is rejected. Flexural tests of selected samples are used for comparative material evaluation,

including resin systems, cure cycles, and glass finishes, and for evaluation of process variables such as impregnating time and tensioning of reinforcement. Flexural tests are useful because they tend to exaggerate the difference between materials. Tensile testing of laminates provides direct values for ultimate strength, modules, and design allowances. Tensile specimens minimize differences between resin systems, but test results correlate well with design data determined from burst cylinders and prototype parts. Hoop tensile strengths are derived from the hydrostatic bursting of cylindrical specimens. Prototypes are used for an evaluation of wrap angle, end shape, fitting design, attachment points, and similar design variables.

6256 APTIC NUMBER 14731

Meyer, P.
THE IMPORTANCE OF HIGH STACKS FOR THE CONCENTRATION OF FLUE DUST PRECIPITATIONS. (Die Bedeutung hoher Schornsteine fuer die Emissionskonzentration). Text in German. Mitt. Ver. Grosskesselbesitzer, 48(6):488-850, Dec. 1968. 6 refs.

The basis of any determination of adequate stack height is the dispersion path of the pollutant through the atmosphere and back to the ground. The newly derived dispersion calculation has some shortcomings, as it is based on normal weather conditions and becomes invalid for temperature inversions. Since 1964, it has been legally required in Germany to build stacks of heights such that the atmospheric SO2 concentration in no case exceeds the upper limit of 0.75 mg SO2/cu m. This maximum value includes background concentration and emitted SO2. Excessively high stacks were obtained through use of previous calculation methods. One factor in the dispersion process is the apparent stack height, although little is known about its influence. The mathematical expression of this factor is based on just 23 measurements, all taken in the vicinity of Duisburg for relatively small emission sources. The new dispersion calculation, which is presently being formulated, will take into account local meteorological conditions for which extensive measurements are required.

6257 APTIC NUMBER 14732

Mueller, Harald
POWER ECONOMY AND AIR POLLUTION. (Energiewirtschaft und Luftverunreinigung). Text in German. Electro-Techniek (The Hague), 46(20):421-430, Oct. 3, 1968. 89 refs.

Types of pollutants, the effects of air pollution on humans, animals, plants, and materials, as well as control measures taken by power plants are reviewed. About 20 to 35% of the solid pollutants in the atmosphere comes from domestic heaters, 35% from industries, and 25% from automobile exhaust gases. Of the gaseous pollutants, the most dangerous is SO2. Regulations in Russia limit their concentration in the atmosphere to 0.06 ppm. In Gelsenkirchen in the Ruhr valley, Germany, a concentration of 0.12 ppm has been measured. The threshold limit value (TLV) referred to eight-hour daily exposure has been set at 5 ppm for NO2. Electrostatic precipitators, mechanical separators, centrifugal separators, scrubbers, and bag filters are all used by power plants. Desulfurization of flue gases and of the fuel is also mentioned as a possible solution. High stacks positively influence the dispersion process. The power output by the plants erected in 1950 rose 375% by 1963. Dust emission, however, has been reduced to 70% of the 1950 value.

6258 APTIC NUMBER 15396

Waito, Jun and Satoru Fujii
AN INCINERATOR. (Shokyakuro). Text in Japanese. (Assignee not given.) Japanese Pat. Sho 44-11707. 2p., May 28, 1969. (Appl. March 24, 1966, 1 claim).

The chimney of this incinerator consists of two concentric cylinders and is provided with a cover at the top. The cover has several holes through which a part of the smoke escapes to the atmosphere. The rest of the smoke is mixed with air through the hole and flows down the inner cylinder. This induces more fresh air to be brought in through the hole. The gas is heated up while flowing down along the inner cylinder which is heated up by the up-flowing hot smoke. The gas is led to the combustion chamber to dilute the smoke and make the combustion more complete.

6259 APTIC NUMBER 15683

Odaira, Toshio
APPROACH TO THE PROGRAM OF AIR POLLUTION CONTROL. (Taikiosen boshikeikaku eno apurochi). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(12):959-965, Dec. 15, 1969. 8 refs.

The problem of air pollution control should be handled with a view to eliminate contaminations for the conservation of a healthy environment for human life, as exemplified by data arrangement and research activities. Emphasis is placed on the importance of close cooperation among natural and social scientists. Only with this cooperation will a final goal aimed at air pollution control be reached with success. The process of air pollution control activity includes a definition of pollutant sources; determination of existing air pollution status and area; investigation of its influence; planning for control; and establishment of an observation system and attainment of ultimate goals to maintain an appropriate environment for human life. A study of emission factors needs to be developed in Japan to obtain original pollutant emission data on which the basic control plan largely depends. The establishment of observation systems which provide objective data in addition to subjective assessment of public health and environment protection comes next in significance. Some ideas are proposed for the observation activity. They include the installation of an automatic recorder at the exit of plant stacks which emit contamination or smoke; the regulation of the constant transmission of data to an observation center, and occasional investigations inside the plants concerned.

6260 APTIC NUMBER 13513

Olmsted, Leonard M.
FAST BREEDERS NEEDED SOON TO CONSERVE URANIUM ORE. Elec. World (12th Annual Nuclear Report), 167(24):109-114, June 1967.

The ultimate goal for nuclear power is to achieve complete and perpetual self-sufficiency in fuel supply. The objective is to develop a power reactor which will breed twice as much fuel in ten years as it consumes. In the fast-neutron spectrum, Pu239 and Pu-241 both have adequate breeding ratios (1.1) and U233 mixed with thorium offers some hope of success. Most breeder projects today are focused on mixed-uranium-and-plutonium fuel in a liquid-sodium-cooled reactor. Sodium-cooled commercial fast breeders of 1000 to 1200 Mwe are anticipated for service by 1978 if operating and fuel costs can be controlled. Steam-cooled breeders are being investigated by Germany and U.S. Interest in the steam-cooled concept generally reflects the belief that it required less new technology and can be applied several years earlier than the sodium-cooled only at lower capital cost. The possibility of using a gas-cooling system is being investigated by the U.S. It is hoped that a gas-cooled breeder could be completed by 1979 or 1980 at a relatively low capital cost. With fuels estimated as low as 0.5 mill/kwhr, it could achieve a very favorable energy cost.

6261 APTIC NUMBER 13549

Osborn, K. D.
URANIUM REFINING IS VITAL STEP. Elec. World, 169(19):86-87, May 6, 1968.

Raw U3O8, as delivered by the uranium mills, contains only 0.711% of the fissionable isotope, U-235. The U3O8 must be refined and converted to high-purity UF6 before it can be enriched to the 2 to 4% of U-235 required by boiling-water and pressurized-water reactors. The refining process presently employed by the AEC involves dissolving the impure uranium concentrates in nitric acid and recovering high-purity uranyl nitrate via solvent extraction. The uranyl nitrate solution is evaporated and calcined to UO3. The UO3 is then reduced with hydrogen to UO2, which reacts with anhydrous hydrofluoric acid to form UF4. Fluorination of the UF4 with elemental fluorine, generated on site by electrolysis of HF, converts it to the final product, UF6. A simplified refining process has been shown to be commercially practical. The new process eliminates the acid dissolution and solvent extraction steps of the original AEC process. The U3O8, after physical preparation, is reacted in a series of fluid beds, reduced to UO2, hydrofluorinated to UF4, and fluorinated with elemental fluorine to crude UF6. The crude UF6 is refined to AEC specification by fractional distillation. A private refinery, operating with the new process, guarantees conversion of 99.5% of the contained uranium in accepted concentrates to the UF6 form within six months of receipt. After 1969, it will be prepared to deliver UF6 within 90 days of receipt. The company furnishes shipping containers and sampling and analytical services as required to assure AEC acceptance.

6262 APTIC NUMBER 14937

Oshio, Toshiki
EMISSION STANDARD AND AMBIENT AIR QUALITY STANDARD FOR SULFUR OXIDES. II. (Io sankabutsu no haishutsukijun to kankyokijun. II). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 5(10):751-765, Oct. 1969.

Ambient air quality should be based on the following: evaluation of measured amounts of sulfur oxides, a numerical criterion for judgement of air pollution, and a maximum allowable concentration in the interest of public health. Various factors which affect sulfur compounds were considered. It was pointed out that geographical features, weather conditions such as high humidity, and coastal pollution should be taken into account in formulating an air quality standard. Numerical criteria should be set with an understanding that human health be given first priority. Studies on the variation of pollution sensitivity with age are now being conducted.

6263 APTIC NUMBER 15540

Pelle, William J., Jr.
I. BIBLIOGRAPHY ON THE PLANNING ASPECTS OF AIR POLLUTION CONTROL. SUMMARY AND EVALUATION. Dec. 18, 1964. 52 refs. II. ANNOTATED BIBLIOGRAPHY ON THE PLANNING ASPECTS OF AIR POLLUTION CONTROL. March 15, 1965 101 refs. Northeast Illinois Planning Commission, Chicago and Public Health Service, Washington, D. C., 38p.

The following areas were evaluated in an examination of planning principles in terms of their applicability to air pollution control: elementary microclimatological considerations in city planning; relationship of air pollution to the 'image' of the city (including aesthetic and psychological effects and the relation of air pollution to urban redevelopment); effects of 'green areas' in air pollution control; relationship of transportation to air pollution; relationship of air pollution through performance standards and densities of population, industry, and traffic. The annotated bibliography containing 101 references involves the following areas: city planning; architecture; landscape architecture; environmental health; climatology; and real estate. The most profound fluctuations in microclimate are due to variations in local topography, to the presence or absence of water bodies, to building mass, and to the structures and cover of the soil. Green 'buffers' can be very effective as filtration devices for dust; green areas can be useful as control measures. With respect to development patterns, attempts have been made to regulate land use on the basis of prevailing winds.

6264 APTIC NUMBER 15093

Persson, Goran
AIR POLLUTION. (Ilman Saastuminen). Text in Finnish. Teknillinen Aikakauslehti, no. 8:29-35, April 1969.

In Sweden, rainwater was analyzed for acidity and sulfate content. The relationship between sulfate emission and sulfate content of the atmosphere is not clear. Acidity runs ahead of sulfate content, possibly due to errors in pH measurement. Lakes have been polluted with acid rain to the point that fish died. Lichens, which constitute reindeer pasture and are extremely sensitive to pH changes, have been endangered. Forestry and agriculture are not yet affected. The average rate of trash disposal in Scandinavia is 300 kg/person/year. In 1967, Sweden consumed 201,000 tons of plastics, 20% chlorine-bearing. In Scandinavia, the three heaviest industrial offenders are pulp, metallurgy, and quarries. On July 1, 1969, a new anti-pollution law was passed in Sweden. Industries dangerous to their environment cannot be built without permission. Present factories will eventually be affected. After 1971, gasoline and diesel vehicles must conform to standards. The sulfur content of fuel oil will be limited to 2.5%, and by January 1970, the lead content of gasoline will be limited to 0.7 g per liter.

6265 APTIC NUMBER 13735

Pickering, J. E. and G. Briggs Phillips
BACK CONTAMINATION. Contamination Control, 7(9):19-23, Sept. 1968. 8 refs.

The Lunar Receiving Laboratory will serve as a biological barrier in prevention of contamination of the earth's surface by the astronauts and Command Module. Immediately upon splashdown, all lunar samples, equipment, and astronauts will be placed in confinement within the Laboratory. The astronauts will be released after 21 days if no alterations in general health occur, and if there is an absence of any infectious disease attributable to lunar exposure. Lunar samples will be handled in sterile laboratories and tested for pathogens. These quarantine methods will insure against any deleterious effects from pathogenic lunar material or microorganisms which may return to earth.

6266 APTIC NUMBER 14783

Popescu, C.
NEW CONTROL METHODS FOR THE GATHERING AND TREATMENT OF GASES WITH FLUORINE CONTENT FROM ALUMINA ELECTROLYSIS. (Metode noi de control la captarea si tratarea gazelor cu continut de fluor de la electroliza alumineii). Text in Romanian. Rev. Chim. (Bucharest), vol. 20:845-847, July 1969. 2 refs.

By developing new methods of determining the content of NaF, NaAlO2, and Na2SO4 in the wash water used for recovering HF, it is possible to reduce by half the time required for checking the recovery process in the aluminum plant laboratory. Detection of NaF is by titration of a solution adjusted to a pH of 2.7 with Th(NO3)4 in the presence of Alizarine S. The NaAlO2 is titrated with a 1N solution of HCl until permanent turbidity is reached, then titrated with bromothymol blue until greenish-yellow. The sulfate is determined by titration with BaCl2 dissolved in acetone or alcohol, in an acetic acid milieu, with Alizarine S as an indicator.

6267 APTIC NUMBER 15519

Public Health Service, Washington, D. C., National Air Pollution Control Administration
AIR QUALITY CRITERIA FOR SULFUR OXIDES. NAPCA Publ. AP-50, 178p., Jan. 1969. 447 refs.

Issued in accordance with the Clean Air Act of 1967, this document reviews the chemical and physical characteristics of sulfur oxides and considers the various analytical methods for measuring them in the atmosphere. The methods include two long-path spectroscopic techniques that sense sulfur dioxide concentrations remotely; they may eventually provide a sulfur dioxide 'pollution contour' for large areas of a city, as well as pollution concentrations at different elevations. Also discussed in the document are the effects of sulfur oxides on visibility, vegetation, and materials. The toxicological effects of sulfur oxides on animals and man are considered. There is also a discussion of epidemiological studies that assess the dose-population response and the response of population subgroups (i.e., children, the elderly, respiratory cripples, etc.) to sulfur oxides and to sulfur dioxide in the presence of particulate matter. Sulfur oxide pollution levels recorded in the Continous Air Monitoring Project show mean annual concentrations ranging from 0.001 ppm in San Francisco to 0.18 ppm in Chicago, with the average exceeding for 1% of the time a concentration between 0.09 ppm and 0.68 ppm. National Air Surveillance Networks annual average concentrations ranged from 0.002 ppm in Kansas City to 0.17 ppm in New York. Geographically, the highest values were recorded in the northeastern part of the United States, where large quantities of fossil fuels are burned.

6268 APTIC NUMBER 18598

Rasmussen, Roberta K. and Harold P. Klein
ACTIVATION OF FATTY ACID SYNTHESIS IN CELL-FREE EXTRACTS OF SACCHAROMYCES CEREVISIAE. J. Bacteriol., 95(1):157-161, Jan. 1968. 20 refs.

Tricarboxylic acid cycle intermediaries and intermediaries of the glycolytic pathway, especially glycerophosphate, stimulate fatty acid synthesis in extracts of Saccharomyces cerevisiae. Magnesium was shown to stimulate fatty acid synthesis from acetyl-coenzyme A but not from malonyl-coenzyme A. This indicates the site of stimulation of fatty acid synthesis is the acetyl coenzyme A step.

6269 APTIC NUMBER 15379

Schedling, J. A.
ANTHROPOGENIC AIR POLLUTANTS. I. AIR POLLUTANTS, LUNG

PENETRATING DUSTS, EMISSION AND IMMISSION. (Anthropogene Luftverunreinigungen. V. Luftfremde Stoffe, lungengaengige Staeube, Emission und Immission). Text in German. Wien. Tieraerztl. Monatsschr., 54(5):383-8, 1967. 7 refs.

In Austria, automobiles have been an important source of air pollution since 1950. Before that date the main sources were domestic heaters, the railroads, and industry. The increase in the number of vehicles between 1958 to 1965, together with the increase in fuel consumption, is represented by a graph. Definitions of dust (particles between 0.1 to 200 microns) and smoke (particles between 0.001 to 0.1 microns) are given. Particles with a Stoke's diameter between 0.1 to 2 microns penetrate into the lungs of humans. Their sedimentation speed is so slow that they remain in the air a long time. Large, rapidly sedimenting particles are dangerous to animals and plants. To determine the air pollution situation, quantitative and qualitative immission measurements and comparison with maximum allowable concentrations are required. Dust measurement methods such as sedimentation, aspiration, and measurement with cyclones are briefly reviewed. Maximum allowable concentrations introduced in West Germany are presented in a table. Nitrogen dioxide limits are 0.5 ppm (long-term value) and 2.0 mg/cu m to 8 hours); sulfur dioxide limits are 0.15 ppm (long-term value) and 0.75 mg/cu m (30 min to 2 hours).

6270 APTIC NUMBER 18396

Shafer, H. P., Jr., C. F. Cockrell, and J. W. Leonard
A NEW AND LOW COST METHOD FOR MAKING STRUCTURAL MATERIALS FROM PROBLEM FLYASHES AND FROM FLYASHES LIKELY TO ORIGINATE FROM CERTAIN POTENTIAL AIR POLLUTION CONTROL PROCESSES. West Virginia Univ., Morgantown, Coal Research Bureau, TP 38, 19p., 1967. 8 refs. (Presented at the AIME Annual Meeting, New York, Feb. 25-29, 1968.)

A significant technological development is discussed for the processing of certain problem power plant fly ashes which contain a high water-soluble mineral content and which are known to yield inferior fly ash-based brick. This development is based on the addition of hydrochloric acid to the fly ash-bottom ash-sodium silicate blends used for the production of fly ash-based structures. Favorable changes are evident in sodium silicate consumption, where often approximately one-half of the amount used for making brick from normal fly ash is required, in processing costs, and in strength and appearance of the resulting freshly formed green and fired structural products. In some high-cost instances (greater than $30 per thousand bricks estimated for normal fly ashes), hydrochloric acid additions can replace or reduce other costly additives required with problem fly ashes to result in a savings of as much as $9 per thousand bricks. These developments offer promising possibilities for utilizing problem fly ashes as well as fly ashes which may come into contact with water-soluble sulfur as a result of the eventual application of certain experimental air pollution control processes. (Author abstract modified)

6271 APTIC NUMBER 15394

AIR CONSERVATION RESEARCH. (Luftvardsforskning). Text in Swedish. In: Research in Environmental Preservation. Part I. The Research Domain. (Miljovardsforskning. Del I. Forskningsomradet). Stockholm, Swedish Dept. of Agriculture, Stockholm, Research Documentation, Bull. 43, 1967, Chapt. 1, p. 18-41.

Chemical and physical properties of the atmosphere, the sources of air pollution, and effects of pollution on humans, animals, plants, materials, weather, and climate are discussed, followed by an analysis of the labor and cost involved in a community air pollution control project. Comparative figures are given for dust, soot, and SO2, content in the air of industrial regions in Sweden as compared with those abroad. Swedish cities have relatively fewer soot and SO2 problems than those of the U. S. and England. Carbon monoxide pollution from motor traffic does not differ from other European cities, but Los Angeles has higher average values. Cost estimates are given for phases of the pollution study project, i.e., methods research, surveys, meteorology, air chemistry, effects on humans and animals, effects on plants, effects on materials, and technical research.

6272 APTIC NUMBER 13588

White, George
ADEQUATE URANIUM RESERVES TO FUEL NUCLEAR POWER GROWTH. Elec. World, 169(19):82-85, May 6, 1968.

The sudden swing to nuclear power generation has spurred concern about the future availability of fuel. The industry consensus is that US nuclear power plant capacity will grow from 12,900-Mw(e) in 1970 to about 200,000-Mw(e) by 1980. Uranium requirements will reach a cumulative 660-million lb of U3O8 by 1980 and a 10-yr forward reserve will require an additional 1.5-billion lb. Based on known and estimated sources, fuel requirements will have depleted assured reserves and one-half of the AEC's stockpile by 1977 and the estimated additional reserves will be gone by 1983. A more realistic approach to forecasting fuel supply is to include probable new discoveries, for uranium reserves do not remain constant. Since new discoveries are not disclosed until sufficient developmental drilling permits accurate delineation of the ore body, a forecast can be made on the evaluation of planned exploration drilling. From this rate, and the record of uranium discoveries per ft drilled, a good estimate for the future can be developed. Based on projected drilling plans and a discovery rate of eight lb per ft drilled, net reserves in 1970 are estimated to be 723-million lb of U3O8, while the 10-yr forward reserve requirement for that year is 661-million lb. Beyond 1970, the drilling will have to be increased 50% in a 15-yr period to meet the forward reserve requirements, but this is a reasonable increase.

SUBJECT INDEX

The terms listed in this subject index are those that most closely describe the information presented in the abstracts. Instead of the APTIC number, the NAPCA ABSTRACT BULLETIN (NAB) number is used to identify the abstracts. The NAB number is shown in the upper left corner of each abstract. This issue includes NAB numbers 4918 - 6272, which are tabulated below to facilitate use of the index.

Category	NAB Number
Emission Sources	4918 - 4994
Control Methods	4995 - 5358
Measurement Methods	5359 - 5536
Air Quality Measurements	5537 - 5583
Atmospheric Interaction	5584 - 5632
Basic Science and Technology	5633 - 6025
Effects-Human Health	6026 - 6117
Effects-Plants and Livestock	6118 - 6155
Effects-Materials	6156 - 6175
Economic Aspects	6176 - 6182
Standards and Criteria	6183 - 6202
Legal and Administrative	6203 - 6239
Social Aspects	6240 - 6243
General and Miscellaneous	6244 - 6272

Preceding page blank

SUBJECT INDEX

ABSORPTION
4921, 4987, 4999, 5001, 5005, 5019, 5059, 5064, 5073
5079, 5080, 5081, 5104, 5123, 5124, 5125, 5133, 5134
5149, 5168, 5175, 5183, 5190, 5197, 5218, 5224, 5232
5239, 5247, 5254, 5257, 5263, 5289, 5312, 5317, 5321
5326, 5341, 5343, 5357, 5419, 5428, 5497, 5510, 5604
5633, 5647, 5648, 5650, 5653, 5656, 5657, 5660, 5703
5736, 5743, 5744, 5745, 5754, 5770, 5806, 5823, 5839
5844, 5854, 5855, 5881, 5892, 5932, 5936, 5937, 5957
5981, 5996,

ADSORPTION
5041, 5044, 5064, 5081, 5096, 5105, 5112, 5152, 5185
5204, 5214, 5232, 5247, 5289, 5296, 5309, 5318, 5320
5376, 5409, 5519, 5635, 5636, 5647, 5648, 5654, 5655
5656, 5660, 5674, 5685, 5696, 5713, 5719, 5720, 5722
5727, 5742, 5793, 5796, 5822, 5830, 5831, 5881, 5929
5935, 5937, 5940, 5955, 5957, 5981, 5985, 6010, 6014

AEROSOL GENERATORS
5766, 5800, 5840, 5909,

AFRICA
5039, 5106, 5236, 5239, 5599, 5767, 5809, 6193,

AFTERBURNERS
4971, 5003, 5018, 5045, 5047, 5057, 5098, 5112, 5160
5162, 5164, 5170, 5179, 5188, 5216, 5333,

AIR QUALITY CRITERIA
5537, 6192, 6197, 6201, 6203, 6215, 6233, 6267,

AIR QUALITY MEASUREMENTS
SEE ALSO: DUST FALL, EMISSION INVENTORIES, AND VISIBILITY
4927, 4938, 4939, 4940, 4942, 4952, 4957, 4958, 4965
4973, 4989, 5006, 5102, 5326, 5361, 5368, 5370, 5375
5379, 5380, 5389, 5394, 5398, 5401, 5405, 5412, 5413
5415, 5425, 5433, 5435, 5442, 5446, 5448, 5452, 5460
5463, 5479, 5484, 5489, 5503, 5519, 5525, 5533, 5534
5538, 5539, 5540, 5541, 5543, 5544, 5545, 5546, 5547
5549, 5551, 5552, 5553, 5554, 5555, 5558, 5560, 5561
5562, 5563, 5564, 5566, 5567, 5568, 5569, 5570, 5571
5572, 5573, 5574, 5575, 5576, 5577, 5579, 5580, 5581
5582, 5583, 5618, 5705, 5788, 5790, 5799, 5907, 6016
6033, 6039, 6041, 6072, 6077, 6153, 6158, 6162, 6165
6174, 6188, 6194, 6215, 6237, 6245, 6246, 6249, 6271

AIR QUALITY STANDARDS
SEE ALSO: MAXIMUM ALLOWABLE CONCENTRATION
5212, 5544, 6194, 6201, 6209, 6227, 6262,

AIR RESOURCE MANAGEMENT
5553, 6178, 6213, 6222, 6237,

AIRCRAFT
SEE ALSO: GAS TURBINES
4929, 4962, 5099, 5216, 5407, 5663, 5695, 5905, 6095

ALDEHYDES
4928, 4971, 4989, 5102, 5188, 5215, 5459, 5533, 5534
5563, 5582, 5921, 6008, 6061, 6108, 6137,

ALIPHATIC HYDROCARBONS
SEE ALSO: ETHYLENE AND METHANES
4928, 4936, 4974, 5000, 5078, 5154, 5160, 5178, 5215
5248, 5255, 5376, 5504, 5515, 5529, 5645, 5660, 5722
5737, 5758, 5769, 5790, 5793, 5822, 5830, 5842, 5963
5986, 6060, 6064,

AMMONIUM COMPOUNDS
4957, 4982, 5036, 5060, 5062, 5067, 5077, 5079, 5102
5104, 5115, 5120, 5139, 5140, 5141, 5194, 5216, 5234
5244, 5268, 5296, 5438, 5572, 5579, 5586, 5612, 5698
5836, 5837, 5839, 5868, 5884, 5932, 5939, 6134, 6144

AREA SURVEYS
4931, 5467, 5539, 5543, 5544, 6039, 6118, 6125, 6221
6237,

AROMATIC HYDROCARBONS
4936, 4957, 4974, 5146, 5217, 5230, 5248, 5417, 5499
5504, 5529, 5583, 5736, 5790, 5878, 5929, 6060, 6064

ARSENIC COMPOUNDS
6136,

ASBESTOS
5869, 6035, 6091,

ASIA
4918, 4940, 4943, 4945, 4964, 4970, 4977, 4978, 4979
4987, 4988, 4993, 5002, 5004, 5005, 5076, 5077, 5078
5079, 5101, 5110, 5122, 5123, 5124, 5128, 5135, 5136
5137, 5138, 5139, 5140, 5141, 5142, 5143, 5148, 5167
5171, 5172, 5173, 5174, 5186, 5187, 5189, 5192, 5195
5196, 5197, 5198, 5199, 5201, 5202, 5206, 5207, 5213
5214, 5215, 5256, 5268, 5280, 5297, 5298, 5299, 5300
5301, 5302, 5303, 5317, 5328, 5349, 5350, 5351, 5352
5361, 5362, 5421, 5422, 5435, 5436, 5439, 5442, 5462
5463, 5465, 5467, 5469, 5470, 5471, 5488, 5508, 5509
5510, 5511, 5512, 5513, 5514, 5515, 5517, 5520, 5533
5534, 5550, 5567, 5568, 5572, 5575, 5576, 5577, 5580
5581, 5582, 5601, 5605, 5615, 5624, 5627, 5647, 5648
5890, 5891, 5901, 5908, 5944, 5945, 5962, 5983, 6008
6011, 6038, 6039, 6055, 6058, 6063, 6064, 6067, 6068

Preceding page blank

6076, 6080, 6081, 6092, 6093, 6096, 6101, 6103, 6105
6109, 6110, 6112, 6113, 6114, 6115, 6116, 6133, 6144
6148, 6156, 6162, 6166, 6176, 6190, 6192, 6216, 6217
6218, 6219, 6224, 6226, 6232, 6233, 6243, 6253, 6258
6259, 6262,

ATMOSPHERIC MOVEMENTS
4953, 4960, 5087, 5366, 5391, 5422, 5464, 5472, 5473
5479, 5501, 5548, 5550, 5559, 5563, 5567, 5571, 5574
5584, 5593, 5596, 5602, 5603, 5607, 5611, 5615, 5617
5619, 5621, 5622, 5625, 5627, 5628, 5631, 5768, 5805
5964, 6064, 6144, 6174, 6206, 6263,

AUTOMOTIVE EMISSION CONTROL
SEE ALSO: AUTOMOTIVE EMISSIONS
4924, 4929, 4930, 4935, 4936, 4947, 4958, 4975, 4977
4978, 4984, 4992, 5018, 5027, 5045, 5047, 5048, 5055
5058, 5075, 5092, 5097, 5098, 5099, 5109, 5114, 5159
5162, 5170, 5176, 5188, 5200, 5210, 5214, 5256, 5293
5315, 5325, 5349, 5362, 5746, 5842, 5877, 6185, 6189

AUTOMOTIVE EMISSIONS
SEE ALSO: AUTOMOTIVE EMISSION CONTROL
4918, 4924, 4928, 4930, 4935, 4936, 4942, 4943, 4945
4947, 4948, 4952, 4958, 4959, 4962, 4964, 4966, 4977
4978, 4979, 4983, 4984, 4988, 4989, 4991, 4992, 5003
5018, 5019, 5027, 5047, 5048, 5055, 5065, 5092, 5099
5109, 5114, 5150, 5154, 5159, 5162, 5176, 5200, 5201
5214, 5221, 5256, 5290, 5315, 5325, 5333, 5362, 5374
5380, 5381, 5383, 5397, 5412, 5423, 5424, 5425, 5449
5453, 5465, 5470, 5472, 5488, 5496, 5499, 5517, 5532
5540, 5547, 5563, 5564, 5568, 5577, 5597, 5654, 5877
5960, 6008, 6039, 6061, 6072, 6077, 6095, 6103, 6110
6147, 6149, 6185, 6188, 6189, 6196, 6224, 6226, 6233
6244, 6249, 6254,

BARIUM COMPOUNDS
5224, 5386, 5676, 5757, 5758, 5950, 6031,

BENZOPYRENES
4952, 5380, 5405, 5427, 5563, 5569, 5575, 6020, 6045
6046, 6058, 6095, 6246,

BOILERS
4997, 5009, 5020, 5039, 5056, 5078, 5099, 5108, 5119
5189, 5233, 5271, 5275, 5298, 5351, 5352, 5356, 5524
5601, 5710, 5787, 5820, 6011, 6160, 6168, 6172,

BORON COMPOUNDS
5839, 5946,

BRONCHITIS
4952, 5538, 5544, 5871, 6028, 6030, 6034, 6035, 6063
6072, 6080, 6092, 6094, 6192,

BY-PRODUCT RECOVERY
4995, 5004, 5017, 5022, 5037, 5038, 5041, 5046, 5053
5060, 5062, 5067, 5094, 5095, 5100, 5115, 5116, 5117
5124, 5136, 5139, 5140, 5141, 5144, 5163, 5178, 5184
5187, 5194, 5206, 5213, 5218, 5219, 5234, 5235, 5242
5244, 5263, 5271, 5281, 5282, 5283, 5297, 5305, 5306
5311, 5314, 5320, 5353, 5645, 5649, 5687, 5741, 5792
5957, 5994, 6001, 6021, 6176, 6179, 6182, 6248, 6249
6266, 6270,

CADMIUM COMPOUNDS
5763, 5900, 5953, 5959, 6133,

CALIBRATION METHODS
5478, 5486, 5517, 5525, 5610, 5811,

CANCER
5417, 6028, 6029, 6033, 6035, 6037, 6058, 6067, 6072
6075, 6091, 6092, 6095, 6103,

CARBON MONOXIDE
4924, 4928, 4929, 4930, 4942, 4943, 4952, 4962, 4966
4977, 4978, 4979, 4981, 4982, 4989, 5006, 5045, 5047
5048, 5054, 5055, 5092, 5098, 5109, 5111, 5151, 5154
5162, 5170, 5177, 5188, 5210, 5221, 5252, 5256, 5261
5284, 5315, 5333, 5346, 5349, 5353, 5369, 5374, 5376
5381, 5404, 5414, 5423, 5444, 5449, 5470, 5472, 5494
5517, 5534, 5538, 5540, 5547, 5548, 5553, 5563, 5564
5567, 5568, 5577, 5579, 5582, 5597, 5604, 5644, 5696
5767, 5772, 5775, 5796, 5799, 5842, 5877, 5898, 5922
5952, 5954, 5960, 5979, 5981, 5992, 6014, 6030, 6039
6040, 6054, 6059, 6061, 6077, 6090, 6117, 6134, 6185
6199, 6201, 6233, 6237, 6257,

CARCINOGENS
5389, 5417, 6020, 6045, 6046, 6058, 6095,

CATALYSIS
SEE ALSO: CATALYTIC OXIDATION
4937, 4996, 5000, 5023, 5044, 5054, 5082, 5101, 5117
5119, 5132, 5134, 5138, 5151, 5152, 5158, 5172, 5188
5194, 5195, 5198, 5204, 5209, 5214, 5223, 5226, 5251
5252, 5258, 5261, 5289, 5319, 5323, 5333, 5353, 5376
5414, 5507, 5634, 5654, 5673, 5713, 5754, 5767, 5772
5773, 5812, 5815, 5824, 5884, 5908, 5948, 5952, 5955
5960, 5973, 5985, 6003, 6005, 6010, 6014, 6176,

CATALYTIC OXIDATION
SEE ALSO: CATALYSIS
4937, 4987, 4996, 5000, 5001, 5005, 5017, 5022, 5023
5026, 5032, 5037, 5041, 5046, 5051, 5057, 5064, 5071
5084, 5090, 5094, 5108, 5112, 5136, 5137, 5138, 5139
5140, 5141, 5157, 5195, 5196, 5205, 5216, 5241, 5245
5261, 5269, 5287, 5305, 5309, 5333, 5344, 5437, 5634
5640, 5673, 5689, 5694, 5696, 5731, 5747, 5748, 5796
5812, 5834, 5835, 5842, 5981, 5984, 6007, 6181, 6182

CENTRIFUGAL SEPARATORS
4933, 4995, 5010, 5034, 5046, 5061, 5129, 5189, 5203
5213, 5242, 5243, 5271, 5272, 5294, 5310, 5322, 5339
5485, 5506, 5641, 5664, 5665, 5666, 5667, 5668, 5797
5807, 5825, 5974, 5983, 6200,

CHEMICAL REACTIONS
SEE ALSO: PHOTOCHEMICAL REACTIONS
4921, 4983, 5005, 5011, 5015, 5036, 5044, 5052, 5082
5113, 5117, 5124, 5132, 5134, 5151, 5170, 5172, 5176
5177, 5186, 5190, 5192, 5194, 5215, 5234, 5239, 5245
5251, 5252, 5258, 5263, 5286, 5308, 5316, 5319, 5323
5326, 5344, 5353, 5401, 5438, 5441, 5458, 5499, 5597
5612, 5642, 5651, 5654, 5690, 5698, 5708, 5712, 5714
5718, 5721, 5723, 5734, 5735, 5743, 5762, 5763, 5767
5775, 5780, 5809, 5813, 5814, 5824, 5836, 5837, 5841
5843, 5844, 5846, 5851, 5853, 5879, 5898, 5902, 5904
5908, 5911, 5921, 5930, 5933, 5943, 5947, 5952, 5955
5960, 5963, 5967, 5975, 5976, 5977, 5982, 5994, 5997
6000, 6003, 6014, 6124, 6159, 6175, 6176, 6177, 6179
6261,

CHILDREN
5538, 5871, 5901, 6033, 6055, 6056, 6068, 6098, 6103
6107, 6113, 6114, 6115, 6116,

CHLORINE COMPOUNDS
SEE ALSO: HYDROCHLORIC ACID AND HALOGENATED HYDROCARBONS
4952, 5125, 5192, 5386, 5410, 5667,

CHROMIUM COMPOUNDS
4987, 4999, 5119, 5222, 5258, 5319, 5388, 5419, 5634
5639, 5757, 6010, 6014,

CIRCULATORY SYSTEM
5508, 6030, 6031, 6040, 6059,

COAL
4919, 4932, 4946, 4955, 4986, 5020, 5022, 5039, 5049
5064, 5066, 5088, 5101, 5192, 5214, 5227, 5264, 5265
5266, 5275, 5276, 5280, 5281, 5302, 5311, 5313, 5326
5365, 5384, 5459, 5556, 5560, 5739, 5755, 5774, 5785
5793, 5872, 5873, 5917, 5918, 5965, 6016, 6019, 6028
6029, 6052, 6094, 6124, 6142, 6176, 6225,

COLORIMETRY
5016, 5214, 5388, 5413, 5415, 5430, 5432, 5442, 5443
5452, 5465, 5466, 5468, 5490, 5505, 5518, 5534, 5571
5573, 6008, 6266,

COLUMN CHROMATOGRAPHY
4991, 5380, 5389, 5453, 5885,

COMBUSTION PRODUCTS
4920, 4926, 4933, 4938, 4940, 4946, 4947, 4951, 4952
4955, 4969, 4971, 4976, 4981, 4982, 4995, 5000, 5003
5004, 5005, 5006, 5007, 5011, 5012, 5013, 5014, 5015
5017, 5021, 5022, 5023, 5024, 5026, 5029, 5032, 5034
5035, 5039, 5040, 5044, 5046, 5049, 5056, 5059, 5060
5061, 5066, 5067, 5070, 5072, 5078, 5079, 5082, 5084
5086, 5089, 5091, 5094, 5096, 5099, 5103, 5104, 5109
5111, 5112, 5115, 5116, 5120, 5124, 5126, 5127, 5128
5132, 5137, 5140, 5141, 5145, 5153, 5157, 5163, 5165
5166, 5178, 5180, 5181, 5182, 5183, 5185, 5187, 5190
5195, 5196, 5197, 5199, 5201, 5205, 5214, 5217, 5218
5219, 5222, 5227, 5228, 5229, 5230, 5231, 5232, 5233
5234, 5235, 5236, 5237, 5244, 5247, 5249, 5250, 5251
5252, 5254, 5257, 5258, 5266, 5267, 5270, 5271, 5275
5276, 5278, 5279, 5280, 5283, 5287, 5290, 5298, 5300
5305, 5308, 5309, 5312, 5313, 5316, 5318, 5334, 5343
5344, 5350, 5351, 5356, 5358, 5369, 5370, 5384, 5387
5402, 5406, 5407, 5418, 5426, 5443, 5455, 5456, 5484
5487, 5492, 5493, 5501, 5505, 5528, 5547, 5560, 5598
5602, 5603, 5605, 5618, 5628, 5729, 5778, 5820, 5824
5876, 6019, 6021, 6072, 6094, 6124, 6133, 6142, 6160
6161, 6165, 6170, 6180, 6200, 6208, 6214, 6224, 6229
6232, 6238, 6249, 6254, 6259,

CONDENSATION (ATMOSPHERIC)
4946, 5501, 5526, 5536, 5544, 5545, 5571, 5605, 5609
5615, 5617, 5618, 5621, 5623, 5631, 5643, 5840, 6249

CONSTRUCTION MATERIALS
4933, 5016, 5106, 5206, 5208, 5352, 5606, 5830, 5831
5869, 5934, 5993, 6022, 6035, 6171, 6173, 6180, 6204
6208, 6229, 6249, 6255, 6257, 6270,

CONTROL AGENCIES
4933, 5146, 5193, 5544, 6188, 6204, 6210, 6211, 6217
6220, 6221, 6223, 6228, 6230,

CONTROL PROGRAMS
5049, 5089, 5146, 5193, 5375, 6188, 6204, 6207, 6210
6213, 6217, 6218, 6227, 6228, 6230, 6232, 6244, 6246
6259,

CONTROLLED ATMOSPHERES
5076, 5545, 5685, 5749, 5922, 5965, 6131,

COPPER COMPOUNDS
5017, 5119, 5125, 5133, 5134, 5222, 5640, 5692, 5732
5738, 5758, 5842, 5958, 6014,

CORROSION
4933, 4952, 4969, 5020, 5030, 5034, 5040, 5056, 5110
5125, 5207, 5212, 5303, 5317, 5348, 5352, 5356, 5524
5578, 5784, 5925, 6156, 6157, 6159, 6160, 6161, 6163
6164, 6165, 6166, 6168, 6169, 6170, 6171, 6172, 6173
6174, 6175, 6180, 6181, 6257,

COSTS
4933, 4952, 4992, 4994, 5015, 5023, 5026, 5033, 5043
5061, 5062, 5068, 5080, 5108, 5112, 5127, 5137, 5139
5141, 5147, 5179, 5183, 5202, 5219, 5222, 5233, 5237
5238, 5244, 5247, 5271, 5280, 5282, 5287, 5308, 5311
5316, 5337, 5338, 5339, 5356, 5447, 5663, 5670, 5807
5847, 5869, 5917, 5918, 5973, 6176, 6177, 6178, 6180
6182, 6193, 6200, 6225, 6234, 6236, 6238, 6247, 6249
6260, 6270, 6271, 6272,

CROPS
4960, 5000, 5043, 5363, 5417, 5447, 5759, 6121, 6125
6126, 6131, 6132, 6133, 6139, 6140, 6148, 6150, 6151
6155, 6180,

DATA HANDLING SYSTEMS
4980, 5007, 5065, 5183, 5222, 5310, 5461, 5479, 5542
5553, 5579, 5592, 5596, 5610, 5619, 5650, 5704, 5710
5727, 5739, 5765, 5770, 5775, 5799, 5860, 5872, 5899
5910, 5917, 5918, 6049, 6178, 6184, 6207, 6236, 6240

DESIGN CRITERIA
4941, 4947, 4953, 4975, 4986, 4994, 5003, 5009, 5015
5029, 5030, 5032, 5034, 5039, 5041, 5045, 5048, 5056
5059, 5060, 5067, 5068, 5069, 5070, 5083, 5097, 5109
5118, 5121, 5128, 5131, 5135, 5143, 5153, 5154, 5166
5170, 5171, 5173, 5176, 5177, 5178, 5181, 5185, 5188
5191, 5195, 5197, 5203, 5210, 5211, 5212, 5216, 5220
5222, 5225, 5233, 5239, 5244, 5257, 5262, 5281, 5283
5287, 5290, 5294, 5308, 5312, 5315, 5322, 5329, 5332
5340, 5343, 5346, 5348, 5349, 5354, 5355, 5359, 5366
5377, 5382, 5387, 5395, 5441, 5450, 5459, 5460, 5467
5479, 5481, 5482, 5485, 5493, 5494, 5506, 5511, 5523
5527, 5529, 5610, 5629, 5637, 5664, 5665, 5681, 5684
5691, 5698, 5699, 5709, 5722, 5725, 5743, 5745, 5749
5751, 5766, 5772, 5784, 5787, 5797, 5798, 5804, 5807
5845, 5850, 5864, 5865, 5867, 5891, 5903, 5922, 5934
5962, 5964, 6011, 6024, 6071, 6077, 6147, 6184, 6202
6256, 6258,

DESULFURIZATION OF FUELS
4922, 4945, 5020, 5051, 5064, 5088, 5101, 5133, 5134
5136, 5151, 5172, 5186, 5192, 5198, 5202, 5207, 5209
5223, 5226, 5237, 5248, 5269, 5271, 5276, 5280, 5281
5282, 5292, 5311, 5321, 5326, 5328, 5465, 5618, 5736
5739, 5785, 5809, 5864, 5873, 5896, 6016, 6025, 6176
6225, 6257,

DIESEL ENGINES
4918, 4928, 4958, 4966, 4975, 4977, 4978, 4991, 4992
5018, 5048, 5057, 5099, 5176, 5188, 5221, 5362, 5425
5449, 5453, 5477, 5499, 5532, 5779, 6196,

DISPERSION
4925, 4940, 4951, 4953, 4955, 4960, 4969, 4980, 4982
5128, 5165, 5166, 5201, 5236, 5237, 5240, 5292, 5302
5356, 5372, 5384, 5385, 5394, 5400, 5406, 5407, 5462
5464, 5465, 5472, 5479, 5500, 5501, 5510, 5548, 5550
5553, 5555, 5560, 5587, 5589, 5593, 5596, 5597, 5598
5599, 5602, 5603, 5607, 5608, 5609, 5610, 5611, 5614
5619, 5622, 5625, 5626, 5627, 5628, 5629, 5630, 5632
5655, 5656, 5660, 5661, 5670, 5672, 5677, 5683, 5697
5704, 5720, 5726, 5740, 5742, 5756, 5768, 5779, 5784
5798, 5802, 5805, 5807, 5827, 5828, 5832, 5843, 5845
5847, 5856, 5862, 5863, 5879, 5880, 5881, 5887, 5889
5894, 5900, 5905, 5929, 5933, 5937, 5944, 5945, 5948
5965, 5966, 5991, 5995, 5999, 6004, 6045, 6074, 6247
6249, 6256,

DUST FALL
4952, 5335, 5367, 5368, 5456, 5463, 5509, 5514, 5515
5548, 5556, 5558, 5565, 5572, 5658, 6055, 6067, 6166
6204, 6269,

ECONOMIC LOSSES
4952, 6125, 6178, 6180,

ELECTRIC POWER PRODUCTION
4922, 4926, 4931, 4946, 4955, 4968, 4976, 4980, 4990
4997, 5007, 5008, 5017, 5022, 5051, 5063, 5064, 5074
5088, 5096, 5099, 5103, 5115, 5118, 5130, 5195, 5206
5237, 5244, 5266, 5269, 5276, 5280, 5281, 5282, 5287
5303, 5305, 5356, 5384, 5394, 5400, 5407, 5482, 5501
5508, 5553, 5556, 5560, 5598, 5602, 5613, 5629, 5630
5688, 5695, 5774, 5870, 6173, 6251, 6254, 6257, 6260
6261, 6272,

ELECTRICAL PROPERTIES
4998, 5070, 5246, 5260, 5265, 5266, 5340, 5490, 5527
5676, 5702, 5721, 5754, 5782, 5794, 5817, 5829, 5919
5920, 5927, 5953, 5959, 5969, 5972, 6006, 6019,

ELECTROCHEMICAL METHODS
5408, 5428, 5441, 5449, 5460, 5476, 5495, 5496, 5505

5510, 5511, 5518, 5566, 5676, 5684, 5700, 5735, 5753
5782, 5794, 5908, 5928, 5959, 6015,

ELECTRON MICROSCOPY
5085, 5378, 5435, 5474, 5605, 5652, 5687, 5727, 5858
5874,

ELECTROSTATIC PRECIPITATORS
4933, 4982, 4994, 4998, 5022, 5025, 5029, 5034, 5040
5046, 5056, 5063, 5068, 5069, 5070, 5074, 5106, 5112
5118, 5129, 5130, 5173, 5184, 5189, 5211, 5213, 5217
5225, 5242, 5243, 5247, 526C, 5265, 5266, 5271, 5273
5285, 5287, 5291, 5339, 534C, 5364, 5498, 6190, 6200

EMISSION INVENTORIES
5394, 5443, 5460, 5557, 6055, 6237,

ENFORCEMENT PROCEDURES
5425, 5515, 6219, 6223,

EPIDEMIOLOGY
5398, 6028, 6029, 6030, 6036, 6037, 6039, 6043, 6050
6054, 6056, 6062, 6063, 6068, 6075, 6080, 6082, 6092
6103, 6113, 6116, 6197, 6262, 6267,

ETHYLENE
4928, 5078, 5529, 5656, 5754, 5758, 5790, 5851, 5857
5878, 5879, 588C, 5881, 5882, 5939,

EUROPE
4919, 4920, 4922, 4925, 4926, 4927, 4928, 4929, 4930
4932, 4933, 4939, 4942, 4943, 4949, 4951, 4952, 4955
4956, 4957, 4965, 4966, 4968, 4969, 4976, 4985, 4989
4992, 4994, 4995, 4996, 4997, 4998, 4999, 5000, 5003
5009, 5012, 5013, 5014, 5016, 5018, 5023, 5024, 5026
5028, 5033, 5036, 5037, 5038, 5042, 5044, 5047, 5049
505C, 5051, 5052, 5055, 5056, 5059, 5061, 5063, 5065
5066, 5067, 5072, 5080, 5081, 5082, 5084, 5085, 5086
5089, 5092, 5093, 5095, 5103, 5104, 5107, 5111, 5116
5117, 5118, 5125, 5126, 5129, 5130, 5132, 5133, 5134
5137, 5144, 5145, 5147, 5149, 5150, 5151, 5152, 5156
5157, 5159, 5161, 5169, 5175, 5177, 5180, 5181, 5184
5190, 5191, 5194, 5204, 5208, 5210, 5211, 5212, 5217
5221, 5224, 5225, 5226, 5227, 5228, 5229, 5230, 5231
5232, 5234, 5235, 5240, 5242, 5243, 5244, 5248, 5249
5250, 5253, 5254, 5257, 5258, 5259, 526C, 5261, 5263
5264, 5267, 5270, 5271, 5273, 5274, 5275, 5277, 5278
5279, 5283, 5285, 5286, 5288, 5289, 5292, 5294, 5295
5296, 5304, 5307, 5309, 5313, 5314, 5316, 5318, 5321
5322, 5323, 5324, 5325, 533C, 5331, 5334, 5335, 5337
5340, 5344, 5345, 5350, 5357, 5358, 5359, 5366, 5367
5368, 5369, 537C, 5371, 5372, 5380, 5381, 5382, 5385
5387, 5388, 5389, 5391, 5394, 5401, 5402, 5405, 5408
5409, 5410, 5412, 5413, 5418, 5424, 5426, 5427, 5428
5432, 5433, 5434, 5438, 5441, 5443, 5444, 5445, 5446
5448, 5450, 5452, 5455, 5464, 5466, 5468, 5473, 5474
5478, 5481, 5483, 5485, 5486, 5492, 5493, 5497, 5498
5500, 5503, 5504, 5505, 5518, 5523, 5524, 5525, 5528
5535, 5536, 5537, 5538, 5540, 5541, 5542, 5543, 5544
5546, 5547, 5548, 5549, 5551, 5552, 5556, 5557, 5558
5559, 5560, 5561, 5562, 5563, 5564, 5565, 5566, 5569
557C, 5571, 5573, 5578, 5579, 5583, 5586, 5590, 5596
5603, 5604, 5607, 5612, 5613, 5614, 5618, 5620, 5621
5622, 5623, 5628, 5629, 563C, 5632, 5633, 5634, 5637
5638, 5639, 5643, 5644, 5645, 5649, 5650, 5653, 5655
5657, 5659, 566C, 5669, 567C, 5671, 5672, 5673, 5674
5675, 5676, 5679, 5680, 5681, 5682, 5683, 5685, 5687
5689, 5690, 5691, 5692, 5694, 5695, 5696, 5698, 5701
5703, 5707, 5708, 5709, 5710, 5711, 5713, 5715, 5716
5717, 5718, 5719, 5722, 5725, 5726, 5727, 5728, 5729
5731, 5732, 5733, 5735, 5738, 5743, 5745, 5748, 5749
5750, 5754, 5755, 5756, 5757, 5758, 5759, 5760, 5761
5762, 5763, 5766, 5769, 5771, 5777, 5778, 5779, 578C
5781, 5784, 5786, 5787, 5789, 5790, 5791, 5792, 5793
5796, 5797, 5799, 5800, 58C1, 5802, 5803, 5808, 5812
5813, 5814, 5815, 5817, 582C, 5822, 5826, 5827, 5828
5834, 5835, 5839, 5843, 5844, 5845, 5846, 5847, 5848
585C, 5852, 5858, 5859, 5861, 5866, 5868, 5870, 5871
5875, 5876, 5877, 5885, 5887, 5892, 5896, 5907, 5912
5913, 5914, 5915, 5916, 5923, 5924, 5925, 5927, 5931
5932, 5935, 5936, 5947, 5948, 5949, 595C, 5951, 5952
5953, 5955, 5956, 5957, 5959, 5961, 5963, 597C, 5972
5974, 5975, 5976, 5977, 598C, 5981, 5982, 5984, 5985
5989, 5990, 5991, 5992, 5993, 6CC0, 6003, 60C4, 6005
6010, 6014, 6018, 6019, 602C, 6022, 6023, 6024, 6025
6026, 6027, 6028, 6029, 6034, 6035, 6036, 6044, 604C
6046, 6048, 6C52, 6059, 6062, 6066, 6071, 6072, 607C
6082, 6084, 6088, 6089, 6091, 6094, 6095, 61C0, 6104
6117, 6119, 6124, 6126, 6127, 6128, 6134, 6136, 6145
6147, 6154, 6156, 6159, 616C, 6161, 6165, 6168, 6169
6170, 6171, 6172, 6174, 6183, 6185, 6186, 6187, 6189
6191, 6206, 6209, 6214, 6223, 6238, 6242, 6244, 6246
6247, 6250, 6251, 6254, 6256, 6257, 6264, 6266, 6269
6271,

EXPOSURE METHODS
5110, 5572, 5749, 6030, 605C, 6051, 6076, 6083, 6085
6117, 6126, 6138, 6153, 6156, 6157,

EYE IRRITATION
4950, 5529, 6033, 6060, 6062, 6064, 6073, 6092, 6093
6243,

FERTILIZER MANUFACTURING
5062, 5234, 5792, 5989, 61C6,

FILTERS
4933, 4982, 4989, 4995, 4998, 5006, 5010, 5016, 5018
5025, 5028, 5030, 5031, 5033, 5040, 5050, 5052, 5061
5064, 5068, 5074, 5076, 5081, 5085, 5091, 5093, 5105
5106, 5118, 5122, 5139, 5143, 5148, 5150, 5167, 5174
5191, 5199, 5208, 5232, 5240, 5242, 5246, 5253, 5254
5271, 5272, 5273, 5278, 5279, 5285, 5291, 5295, 5306
5307, 5327, 5331, 5334, 5339, 5345, 5348, 5386, 5392
5405, 5445, 5455, 5468, 5481, 5482, 5488, 5641, 5659
5789, 5839, 5866, 5942, 5968, 6139, 6190, 6200, 6249

FLAME IONIZATION DETECTOR
4943, 4991, 5395, 5424, 5429, 5437, 5460, 5503, 5517
5525, 5561, 6008,

FLUORINE COMPOUNDS
SEE ALSO: HALOGENATED HYDROCARBONS
4944, 4982, 5304, 5309, 5317, 5318, 5324, 5454, 5476
5534, 5554, 5565, 5618, 5637, 5671, 5683, 5691, 5776
5784, 5907, 5989, 6026, 6078, 6106, 6120, 6128, 6138
6152, 6155, 6201, 6266,

FOOD AND FEED OPERATIONS
5052, 5057, 5149, 5259, 5297, 5695, 6241,

FUEL ADDITIVES
4936, 4958, 5020, 5064, 5098, 5114, 5221, 5303, 5333
5362, 5663, 6110,

FUEL GASES
4954, 4955, 4990, 5006, 5028, 5072, 5133, 5134, 5154
5161, 5176, 5194, 5221, 5226, 5276, 5286, 5307, 5311
5325, 5618, 5645, 5709, 5760, 5774, 5824, 5852, 5870
6064, 6073, 6176,

FUEL OILS
4945, 4954, 4955, 4968, 4970, 5006, 5064, 5172, 5196
5198, 5202, 5209, 5214, 5221, 5223, 5269, 5275, 5276
5280, 5282, 5303, 5337, 5352, 5362, 5560, 5645, 5736
5774, 5809, 5829, 5876, 5918, 6073, 6142, 6158, 6170
6176, 6249,

FURNACES
4941, 4963, 4986, 4995, 5003, 5034, 5042, 5099, 5143
5214, 5288, 5301, 5307, 5338, 5418, 5455, 5524, 5741
5760, 5774, 5916, 6160, 6174, 6175, 6249,

GAS CHROMATOGRAPHY
SEE ALSO: FLAME IONIZATION DETECTOR
4991, 5369, 5374, 5379, 5404, 5410, 5429, 5449, 5453
5458, 5460, 5469, 5475, 5486, 5487, 5492, 5516, 5519
5535, 5583, 5758, 5760, 5765, 5790, 5838, 6008,

GAS SAMPLING
4973, 5368, 5395, 5397, 5398, 5404, 5407, 5415, 5426
5440, 5452, 5455, 5459, 5468, 5469, 5481, 5484, 5487
5516, 5517, 5804,

GAS TURBINES
4929, 4972, 5093, 5176, 5286, 5303,

GASOLINES
4924, 4935, 4936, 4945, 4959, 5114, 5200, 5214, 5248
5315, 5325, 5397, 5588, 5809, 5917, 6110,

HALOGENATED HYDROCARBONS
4921, 5429, 5503, 5519, 5667, 5868, 5869, 6161,

HEMATOLOGY
5444, 5644, 5979, 6030, 6040, 6054, 6077, 6085, 6087
6090, 6110, 6199,

HIGHWAYS
5568,

HYDROCHLORIC ACID
4921, 5056, 5410, 5520, 6161,

HYDROGEN SULFIDE
4952, 4957, 4973, 4985, 5053, 5066, 5067, 5073, 5100
5112, 5124, 5132, 5156, 5168, 5207, 5216, 5218, 5255
5268, 5281, 5309, 5314, 5321, 5326, 5415, 5451, 5468
5504, 5534, 5535, 5722, 5736, 5754, 5770, 5844, 5961
5985, 6134, 6169, 6250,

INCINERATION
4941, 4952, 4967, 4980, 4981, 4986, 4994, 5029, 5034
5040, 5056, 5064, 5068, 5099, 5102, 5147, 5173, 5178
5193, 5243, 5247, 5262, 5283, 5297, 5299, 5300, 5346
5351, 5456, 5484, 5941, 6160, 6161, 6202, 6215, 6241
6258,

INVERSION
4980, 5087, 5537, 5548, 5585, 5613, 5615, 5618, 5620
5622, 5623, 5628, 5805, 6030,

IRON COMPOUNDS
4949, 5016, 5020, 5067, 5090, 5119, 5144, 5222, 5258
5261, 5687, 5692, 5732, 5733, 5741, 5761, 5767, 5781
5846, 5872, 5873, 5911, 5915, 5940, 5976, 5981, 5984
6005, 6010, 6031, 6088,

ISOTOPES
5216, 5406, 5440, 5542, 5637, 5638, 5646, 5665, 5666
5667, 5668, 5670, 5671, 5683, 5691, 5720, 5733, 5751
5752, 5761, 5770, 5784, 5797, 5798, 5802, 5807, 5816

5825, 5839, 5845, 5864, 5865, 5886, 5896, 5944, 5945
5956, 5974, 5983, 5998, 6024, 6025, 6177, 6247,

KRAFT PULPING
4973, 5071, 5094, 5108, 5168, 5218, 5237, 5245, 5297
5487, 5994, 6021, 6264,

LABORATORY ANIMALS
5508, 5724, 5725, 5733, 5786, 5885, 5990, 6031, 6032
6038, 6040, 6045, 6046, 605C, 6051, 6053, 6059, 6066
6069, 6C7C, 6C71, 6074, 6076, 6079, 6081, 6083, 6085
6087, 6102, 6110, 6111, 6112, 6147, 6183, 6250,

LASERS
5373, 5393, 5501, 5521, 5526, 5545, 5602, 5610, 5712
5718, 5783, 5805, 5808, 5816, 5839, 585C, 5889, 5893
5899, 5919, 5939, 5971, 5978, 5986, 5988, 5998, 6006
6009,

LEAD COMPOUNDS
4935, 4936, 4948, 4961, 4963, 4966, 4988, 4989, 5098
5308, 5333, 5412, 5430, 5432, 5434, 5488, 5552, 5563
5564, 5568, 5580, 5581, 5663, 5738, 5940, 5947, 6018
6048, 6110, 6133, 6150, 6201,

LEGAL ASPECTS
4933, 4943, 4954, 5006, 5047, 5049, 5051, 5085, 5106
5142, 5158, 5164, 5238, 5334, 5346, 537C, 5425, 5446
5515, 5544, 6C73, 6145, 6189, 6193, 6196, 6199, 6201
6206, 6208, 6209, 621C, 6211, 6212, 6214, 6215, 6216
6217, 6218, 6219, 6220, 6223, 6224, 6226, 6227, 6228
6229, 6230, 6232, 6233, 6234, 6235, 6237, 6244, 6245
6249, 6253, 6263, 6264, 6267,

LIGHT RADIATION
5419, 5475, 5521, 5536, 5574, 5604, 5617, 5717, 5718
5723, 5728, 5764, 585C, 5998, 6008, 6012, 6013, 6108

LIGHT SCATTERING
5016, 5373, 5531, 5536, 5545, 5588, 5590, 5591, 5604
5716, 5717, 5801, 581C, 5889, 5899, 5971, 6135,

MANGANESE COMPOUNDS
4993, 5017, 5067, 5119, 5372, 5386, 5508, 5733, 5826
5885, 5955, 5976, 6031, 6053, 6057, 6066,

MATHEMATICAL ANALYSES
SEE ALSO: MATHEMATICAL MODELING
4925, 4940, 456C, 4959, 4979, 4983, 4989, 5116, 5167
5174, 5190, 5198, 5225, 5236, 5322, 5394, 5398, 5416
5456, 5464, 5577, 5590, 5592, 5598, 560C, 5603, 5625
5626, 5635, 5639, 5641, 5651, 5656, 5666, 5678, 5679
568C, 5683, 5695, 5702, 5705, 5709, 5715, 5716, 5718
5720, 5726, 5728, 5747, 5751, 5753, 5755, 5756, 5768
5779, 5787, 5789, 5795, 5799, 5801, 5802, 5803, 5807
5827, 584C, 5845, 5847, 5849, 5855, 5862, 5875, 5887
5891, 5894, 5901, 5906, 5908, 5923, 5927, 5937, 5941
5944, 5966, 5971, 5980, 5983, 5992, 5995, 6002, 6004
6017, 6177, 6187, 6191, 6256,

MATHEMATICAL MODELING
4934, 4983, 5007, 5183, 531C, 5315, 5400, 5461, 5472
5521, 5587, 5996, 5609, 5614, 5628, 5631, 5632, 5646
5661, 5686, 5697, 5699, 5704, 5716, 5717, 5740, 5743
5744, 5745, 5747, 5752, 5781, 5789, 5795, 5828, 5849
5863, 5879, 5910, 5974, 598C, 5991, 6023, 6044,

MAXIMUM ALLOWABLE CONCENTRATION
4952, 4987, 5212, 5448, 5551, 6077, 6085, 6183, 6186
6187, 6189, 6190, 6191, 6192, 6194, 6198, 6199, 6209
6215, 6249, 6256, 6269,

MERCURY COMPOUNDS
5415, 5794,

METAL COMPOUNDS
SEE ALSO: SPECIFIC METAL COMPOUNDS
4963, 4993, 4996, 4999, 5002, 5010, 5017, 5020, 5046
505C, 509C, 5101, 5107, 5113, 5119, 5125, 5133, 5134
5139, 5149, 5155, 5198, 5209, 5216, 5222, 5224, 5228
5230, 5249, 5257, 5301, 5303, 5308, 5313, 5314, 5373
5386, 5530, 5542, 5634, 5637, 5639, 5640, 5653, 5662
5666, 5670, 5671, 5673, 5675, 5676, 5679, 5680, 5682
5683, 5691, 5692, 5700, 5701, 5702, 5703, 5707, 5711
5714, 5721, 5732, 5733, 5739, 5750, 5753, 5758, 5761
5767, 5774, 5781, 5782, 5784, 5791, 5792, 5794, 5797
5807, 5812, 5817, 5819, 5821, 5826, 5836, 5837, 5841
5842, 5845, 5847, 5859, 5864, 5865, 5885, 5913, 5921
593C, 5936, 594C, 5943, 5949, 5950, 5951, 5953, 5956
5978, 5997, 6005, 601C, 6015, 6018, 6031, 6053, 6057
6133, 6138, 6165, 6247, 6260, 6261, 6272,

METALS
SEE ALSO: METAL COMPOUNDS AND SPECIFIC METAL COMPOUNDS
4920, 4944, 4993, 4995, 5000, 5030, 5042, 5060, 5110
5111, 5125, 5144, 5178, 5204, 5206, 5207, 5209, 5304
5338, 5352, 5373, 5430, 5455, 5483, 5507, 5509, 5554
5555, 5565, 5615, 5618, 5694, 5696, 5730, 5861, 5884
5903, 5908, 5911, 5913, 5914, 5925, 5945, 5955, 5959
5973, 5975, 6007, 6026, 6042, 6087, 6105, 6128, 6146
6156, 6157, 6159, 6161, 6162, 6163, 6164, 6165, 6169
6170, 6171, 6180, 624C, 6266, 6268,

METHANES
5154, 5177, 5205, 5369, 5404, 5429, 5437, 5449, 5459

5518, 5525, 5604, 5737, 5739, 5746, 5758, 5760, 5793
5852, 5868, 5883, 5922, 5963, 6009, 6019,

MICROORGANISMS
4923, 4927, 5052, 5186, 5306, 5361, 5372, 5376, 5377
5491, 5608, 5766, 5841, 5867, 5890, 5897, 6020, 6065
6074, 6075, 6087, 6096, 6108, 6130, 6143, 6265, 6268

MINERAL PROCESSING
4926, 4933, 4982, 5043, 5101, 5106, 5131, 5150, 5192
5208, 5239, 5272, 5297, 5354, 5364, 5365, 5459, 5965
6028, 6052, 6058, 6133, 6204, 6208, 6229, 6264,

MINERAL PRODUCTS
SEE ALSO: ASBESTOS
5002, 5015, 5016, 5145, 5149, 5196, 5244, 5261, 5281
5305, 5308, 5311, 5356, 5454, 5507, 5586, 5658, 5836
5858, 5866, 5869, 5872, 5873, 5934, 5968, 6091, 6170
6180, 6248,

MONITORING
5112, 5214, 5335, 5365, 5370, 5375, 5383, 5387, 5391
5393, 5399, 5402, 5407, 5408, 5414, 5415, 5422, 5429
5437, 5440, 5441, 5443, 5446, 5449, 5453, 5455, 5462
5463, 5470, 5484, 5486, 5487, 5493, 5495, 5496, 5501
5503, 5507, 5511, 5524, 5533, 5534, 5552, 5558, 5562
5564, 5567, 5577, 5579, 5922, 6105, 6147, 6251, 6259

NICKEL COMPOUNDS
5119, 5222, 5713, 5732, 5754, 5796, 5846, 5914, 5940
5951, 5985, 6010, 6031,

NITRATES
4948, 5080, 5104, 5221, 5257, 5308, 5653, 5662, 5675
5682, 5700, 5702, 5714, 5792, 5815, 5819, 5997, 6008
6015, 6120, 6141, 6149,

NITROGEN OXIDES
4928, 4929, 4932, 4934, 4947, 4952, 4954, 4959, 4962
4966, 4972, 4978, 4982, 4984, 4987, 4989, 5000, 5001
5005, 5006, 5011, 5036, 5041, 5048, 5054, 5055, 5065
5079, 5080, 5081, 5096, 5098, 5102, 5104, 5114, 5154
5190, 5194, 5205, 5214, 5216, 5221, 5224, 5232, 5239
5251, 5252, 5257, 5258, 5263, 5286, 5296, 5309, 5315
5316, 5320, 5323, 5325, 5374, 5396, 5401, 5410, 5413
5414, 5449, 5466, 5468, 5475, 5494, 5495, 5496, 5520
5529, 5534, 5538, 5547, 5553, 5563, 5567, 5568, 5577
5579, 5582, 5588, 5597, 5604, 5653, 5654, 5690, 5708
5762, 5764, 5783, 5813, 5814, 5824, 5877, 5884, 5886
5893, 5898, 5902, 5906, 5920, 5938, 5952, 5955, 5960
5987, 5997, 6001, 6003, 6008, 6012, 6013, 6033, 6038
6050, 6051, 6060, 6061, 6063, 6073, 6108, 6111, 6112
6120, 6162, 6166, 6186, 6189, 6201, 6257,

ODORIMETRY
4956, 5379, 5431, 5469, 5477, 5486, 6085,

ODORS
4951, 4956, 4958, 4980, 4991, 5052, 5071, 5076, 5094
5102, 5149, 5160, 5173, 5178, 5179, 5197, 5215, 5218
5255, 5259, 5291, 5299, 5300, 5318, 5379, 5431, 5453
5469, 5477, 5499, 5544, 5583, 5064, 6079, 6085, 6200
6208, 6215, 6229, 6232, 6242, 6243,

OPEN BURNING
4960,

ORGANIC NITROGEN COMPOUNDS
4957, 5021, 5183, 5215, 5379, 5417, 5458, 5483, 5518
5675, 5712, 5745, 6008, 6069, 6070,

ORGANIC SULFUR COMPOUNDS
4973, 5101, 5186, 5192, 5226, 5245, 5268, 5318, 5379
5469, 5838, 5994, 6064, 6121,

OXIDANTS
5513, 5574, 6033, 6061, 6083, 6123, 6129, 6153, 6180
6201,

OZONE
4982, 5215, 5245, 5393, 5413, 5414, 5441, 5479, 5480
5494, 5513, 5534, 5538, 5562, 5563, 5568, 5593, 5723
5790, 5804, 5822, 5954, 5964, 5967, 6063, 6083, 6111
6120, 6121, 6122, 6123, 6130, 6131, 6139, 6140, 6143
6153, 6167, 6186,

PAPER CHROMATOGRAPHY
5380,

PARTICLE COUNTERS
4938, 5085, 5359, 5364, 5392, 5420, 5448, 5478, 5527
5546, 5768,

PARTICLE SIZE
4939, 4948, 4963, 4970, 5015, 5016, 5122, 5246, 5253
5315, 5324, 5326, 5356, 5359, 5385, 5390, 5405, 5416
5420, 5421, 5430, 5435, 5448, 5450, 5485, 5488, 5497
5506, 5523, 5527, 5531, 5578, 5590, 5591, 5600, 5621
5624, 5633, 5659, 5697, 5716, 5757, 5768, 5795, 5800
5840, 5866, 5873, 5899, 5900, 5927, 5931, 5948, 5953
5972, 5988, 5989, 6019, 6022, 6041, 6174, 6190,

PARTICULATE SAMPLING
5368, 5392, 5398, 5436, 5445, 5456, 5482, 5487, 5523
5555, 5619, 6269,

PARTICULATES
SEE ALSO: POLLENS AND SMOG
4918, 4920, 4923, 4925, 4929, 4933, 4938, 4939, 4941
4946, 4948, 4949, 4952, 4954, 4958, 4960, 4961, 4964
4970, 4971, 4976, 4980, 4981, 4982, 4992, 4993, 4994
4995, 4997, 4998, 5006, 5009, 5016, 5018, 5022, 5024
5025, 5028, 5029, 5033, 5034, 5039, 5040, 5042, 5046
5056, 5059, 5061, 5062, 5063, 5068, 5070, 5074, 5076
5077, 5081, 5083, 5084, 5085, 5093, 5102, 5105, 5106
5108, 5109, 5111, 5112, 5115, 5118, 5121, 5122, 5129
5130, 5131, 5135, 5143, 5144, 5148, 5160, 5171, 5173
5178, 5184, 5189, 5191, 5203, 5206, 5208, 5211, 5213
5217, 5220, 5233, 5236, 5238, 5239, 5240, 5242, 5243
5246, 5253, 5254, 5260, 5265, 5266, 5271, 5272, 5273
5279, 5285, 5287, 5288, 5291, 5292, 5294, 5295, 5299
5300, 5306, 5307, 5309, 5310, 5312, 5315, 5322, 5324
5331, 5332, 5334, 5335, 5338, 5342, 5345, 5346, 5347
5351, 5354, 5357, 5359, 5362, 5364, 5367, 5370, 5378
5380, 5382, 5385, 5386, 5387, 5391, 5392, 5399, 5403
5405, 5418, 5420, 5421, 5422, 5424, 5428, 5430, 5432
5433, 5435, 5436, 5445, 5446, 5448, 5450, 5455, 5462
5464, 5471, 5474, 5478, 5481, 5482, 5484, 5485, 5487
5488, 5493, 5497, 5498, 5500, 5502, 5506, 5509, 5514
5515, 5520, 5523, 5527, 5528, 5531, 5532, 5536, 5537
5538, 5539, 5541, 5543, 5544, 5545, 5548, 5552, 5553
5555, 5556, 5557, 5558, 5559, 5567, 5568, 5569, 5572
5575, 5576, 5577, 5578, 5582, 5583, 5588, 5590, 5591
5592, 5595, 5599, 5600, 5605, 5612, 5615, 5617, 5619
5620, 5624, 5629, 5630, 5633, 5658, 5687, 5696, 5716
5717, 5725, 5728, 5755, 5766, 5768, 5788, 5795, 5800
5803, 5805, 5810, 5820, 5840, 5843, 5848, 5858, 5866
5867, 5870, 5875, 5890, 5895, 5900, 5905, 5909, 5916
5923, 5931, 5932, 5942, 5964, 5965, 5966, 5968, 5969
5980, 5982, 5988, 5989, 5993, 6011, 6023, 6028, 6029
6030, 6031, 6035, 6039, 6041, 6044, 6046, 6047, 6052
6055, 6056, 6062, 6063, 6071, 6072, 6073, 6074, 6084
6088, 6089, 6094, 6097, 6098, 6108, 6109, 6147, 6166
6170, 6174, 6180, 6188, 6190, 6192, 6194, 6196, 6197
6200, 6201, 6204, 6206, 6208, 6215, 6224, 6229, 6232
6235, 6237, 6242, 6248, 6249, 6251, 6253, 6254, 6263
6269, 6270, 6271,

PESTICIDES
5458, 6183,

PETROLEUM REFINING
4951, 5053, 5237, 5297, 5314, 5736, 6242, 6243, 6244

PHOSPHORUS COMPOUNDS
4982, 5046, 5098, 5707, 5714, 5782, 5836, 5837, 5928
6099, 6135, 6152,

PHOTOCHEMICAL REACTIONS
4934, 4948, 4950, 4974, 5437, 5500, 5529, 5588, 5644
5721, 5723, 5737, 5902, 5967, 5986, 6002, 6008, 6012
6013, 6149.

PHOTOMETRIC METHODS
5050, 5362, 5383, 5412, 5478, 5483, 5487, 5490, 5555
5572, 5600, 5623, 6105,

PLANS AND PROGRAMS
SEE ALSO: AREA SURVEYS AND CONTROL PROGRAMS
5173, 5335, 5363, 5375, 5447, 5457, 5467, 5537, 5548
5567, 6067, 6118, 6184, 6205, 6231, 6239, 6240, 6251
6253,

PLASTICS
5178, 5299, 5352, 5386, 5853, 5869, 5888, 5934, 6255

PNEUMOCONIOSIS
SEE ALSO: RESPIRATORY DISEASES AND BRONCHITIS
5239, 5354, 5364, 6035, 6052, 6091, 6094,

POLLENS
4965, 5411, 6056,

POLYNUCLEAR COMPOUNDS
SEE ALSO: PYRENES AND BENZOPYRENES
4928, 4952, 5389, 5502, 5538, 5544, 5725, 5879, 6020
6072,

PRECIPITATION
4961, 5538, 5544, 5586, 5605, 5617, 5631, 5661, 5848
5964, 6010, 6127, 6144, 6150, 6174,

PULMONARY FUNCTION
SEE ALSO: RESPIRATORY FUNCTIONS
6030, 6035, 6047, 6049, 6055, 6061, 6097, 6103, 6104
6107, 6109, 6112,

RADIOACTIVE RADIATION
4993, 5380, 5399, 5406, 5416, 5418, 5440, 5458, 5482
5549, 5600, 5624, 5661, 5727, 5874, 5915, 5931, 5942
6053, 6071, 6089, 6160, 6186,

REACTION KINETICS
4934, 4972, 4983, 5080, 5198, 5222, 5232, 5236, 5281
5326, 5644, 5648, 5651, 5653, 5656, 5686, 5689, 5690
5694, 5696, 5703, 5721, 5723, 5726, 5731, 5739, 5747
5756, 5775, 5812, 5814, 5822, 5842, 5852, 5884, 5887
5904, 5908, 5911, 5913, 5914, 5915, 5940, 5948, 5949
5950, 5963, 5981, 5982, 5985, 5996, 6003, 6005, 6014
6017, 6060,

REACTION MECHANISMS
4921, 4932, 5079, 5113, 5215, 5284, 5612, 5647, 5696
5701, 5707, 5723, 5750, 5761, 5764, 5773, 5775, 5780
5781, 5796, 5813, 5815, 5822, 5837, 5843, 5844, 5852
5884, 5898, 5908, 5912, 5915, 5919, 5920, 5946, 5963
5996, 6005, 6014,

RESEARCH PROGRAMS
5049, 5099, 5118, 5129, 5158, 5238, 5264, 5339, 5350
5554, 5910, 6075, 6218, 6246, 6271,

RESPIRATORY DISEASES
SEE ALSO: BRONCHITIS AND PNEUMOCONIOSIS
4923, 4954, 5413, 5538, 5871, 6030, 6031, 6033, 6034
6035, 6037, 6039, 6041, 6043, 6047, 6050, 6052, 6056
6062, 6065, 6068, 6072, 6073, 6080, 6082, 6091, 6092
6093, 6096, 6097, 6098, 6101, 6103, 6104, 6107, 6109
6113, 6114, 6115, 6116, 6243,

RESPIRATORY FUNCTIONS
SEE ALSO: PULMONARY FUNCTION
5901, 6032, 6034, 6041, 6042, 6043, 6055, 6061, 6068
6071, 6074, 6077, 6089, 6097, 6101, 6103, 6111, 6112

RESPIRATORY SYSTEM
4952, 5508, 5724, 6030, 6031, 6032, 6038, 6041, 6044
6045, 6046, 6047, 6051, 6055, 6065, 6066, 6074, 6076
6081, 6082, 6084, 6088, 6089, 6094, 6096, 6104, 6112
6269,

SAMPLERS
SEE ALSO: SOURCE SAMPLING
4948, 5364, 5377, 5392, 5397, 5398, 5403, 5406, 5411
5412, 5421, 5424, 5428, 5435, 5448, 5450, 5459, 5462
5463, 5482, 5484, 5487, 5491, 5498, 5502, 5514, 5515
5523, 5552, 5559, 5576, 5583, 5619, 5621, 5727, 5742
5751, 5803, 5878, 5900, 6177, 6190,

SCRUBBERS
4921, 4982, 4985, 4997, 4998, 5001, 5004, 5021, 5025
5036, 5037, 5040, 5044, 5053, 5059, 5061, 5062, 5064
5067, 5068, 5077, 5094, 5096, 5104, 5106, 5108, 5111
5115, 5116, 5118, 5119, 5124, 5129, 5144, 5149, 5153
5155, 5173, 5181, 5203, 5214, 5218, 5233, 5244, 5247
5250, 5254, 5257, 5263, 5271, 5272, 5273, 5276, 5278
5288, 5290, 5304, 5305, 5307, 5309, 5312, 5332, 5334
5338, 5339, 5342, 5343, 5344, 5355, 5356, 5357, 5589
5729, 5800, 5993, 6200,

SELENIUM COMPOUNDS
5344, 5428, 5770,

SIMULATION
5065, 5110, 5310, 5398, 5529, 5553, 5587, 5611, 5628
5643, 5787, 5800, 5906, 5964, 5965, 5991, 6061, 6084
6088, 6089,

SKIN
6096,

SMOG
4934, 4950, 4954, 4971, 4974, 5087, 5097, 5154, 5176
5293, 5437, 5452, 5475, 5500, 5529, 5574, 5595, 5613
5615, 5617, 6180, 6188, 6206,

SOLVENTS
4971, 4974, 5112, 5146, 5164, 5179, 5185, 5299, 5360
5475, 5490, 5503, 5529, 5682, 5706, 5817, 6064, 6179

SOURCE SAMPLING
SEE ALSO: SAMPLERS
5392, 5424, 5484, 5487, 5493, 6214,

SO2 REMOVAL (COMBUSTION PRODUCTS)
4955, 4976, 4982, 4996, 5002, 5004, 5006, 5007, 5010
5012, 5013, 5014, 5015, 5017, 5021, 5022, 5024, 5026
5032, 5035, 5037, 5038, 5046, 5049, 5051, 5053, 5060
5062, 5066, 5081, 5082, 5084, 5086, 5091, 5096, 5100
5103, 5107, 5113, 5115, 5119, 5120, 5123, 5126, 5132
5136, 5137, 5139, 5140, 5141, 5145, 5155, 5156, 5157
5163, 5182, 5183, 5185, 5187, 5195, 5196, 5199, 5201
5219, 5222, 5227, 5228, 5229, 5230, 5231, 5233, 5234
5235, 5236, 5237, 5241, 5244, 5249, 5250, 5251, 5252
5264, 5267, 5269, 5271, 5275, 5276, 5277, 5278, 5284
5287, 5292, 5298, 5301, 5302, 5305, 5309, 5312, 5313
5330, 5337, 5344, 5350, 5351, 5353, 5356, 5465, 5508
5703, 5722, 5729, 5812, 5961, 5987, 6170, 6248, 6257

SPARK IGNITION ENGINES
4984, 5099, 5154, 5349, 5709,

SPECTROMETRY
4943, 5175, 5284, 5360, 5365, 5371, 5389, 5410, 5419
5427, 5449, 5457, 5470, 5480, 5488, 5490, 5494, 5499
5502, 5504, 5519, 5530, 5649, 5657, 5696, 5714, 5715
5723, 5762, 5764, 5770, 5771, 5784, 5808, 5814, 5822
5823, 5839, 5860, 5865, 5886, 5898, 5920, 5939, 5960
5969, 5978, 5981, 6000,

SPECTROPHOTOMETRY
5390, 5424, 5432, 5436, 5438, 5444, 5468, 5489, 5490
5508, 5509, 5522, 5530, 5533, 5534, 5552, 5569, 5642
5656, 5775, 5926, 6012, 6013, 6133,

STREETS
4942, 5083, 5412, 5470, 5547, 5552, 5561, 5562, 5563
5564, 5580, 5606,

SULFUR COMPOUNDS
SEE ALSO: HYDROGEN SULFIDE
4919, 4922, 4948, 4973, 5020, 5038, 5060, 5062, 5067
5071, 5088, 5090, 5098, 5100, 5101, 5108, 5110, 5115
5116, 5117, 5120, 5139, 5141, 5156, 5157, 5177, 5192
5202, 5215, 5230, 5231, 5241, 5245, 5255, 5268, 5282
5305, 5309, 5311, 5313, 5353, 5365, 5374, 5379, 5409
5451, 5476, 5486, 5487, 5535, 5544, 5612, 5692, 5713
5732, 5736, 5741, 5750, 5761, 5763, 5764, 5777, 5782
5791, 5822, 5829, 5836, 5837, 5846, 5872, 5873, 5911
5914, 5915, 5921, 5925, 5928, 5936, 5947, 5949, 5950
5951, 5953, 5958, 5976, 5977, 5985, 5994, 6000, 6005
6016, 6018, 6073, 6160, 6161, 6169, 6172, 6179, 6225
6250,

SULFUR OXIDES
4920, 4926, 4928, 4929, 4937, 4940, 4948, 4951, 4952
4954, 4955, 4962, 4964, 4976, 4977, 4978, 4982, 4999
5001, 5006, 5007, 5010, 5012, 5013, 5014, 5024, 5051
5054, 5056, 5066, 5081, 5082, 5091, 5096, 5098, 5107
5110, 5112, 5113, 5117, 5123, 5126, 5127, 5136, 5138
5139, 5145, 5149, 5156, 5163, 5177, 5182, 5183, 5197
5199, 5204, 5213, 5214, 5216, 5217, 5228, 5249, 5251
5252, 5260, 5269, 5275, 5276, 5277, 5278, 5279, 5284
5287, 5292, 5301, 5305, 5308, 5309, 5312, 5313, 5318
5320, 5330, 5335, 5341, 5344, 5353, 5374, 5376, 5383
5384, 5387, 5391, 5394, 5407, 5409, 5414, 5422, 5439
5442, 5443, 5452, 5462, 5463, 5468, 5471, 5473, 5476
5492, 5495, 5496, 5504, 5505, 5510, 5511, 5512, 5515
5520, 5524, 5528, 5534, 5535, 5537, 5538, 5541, 5543
5544, 5547, 5548, 5550, 5551, 5553, 5557, 5558, 5560
5563, 5566, 5567, 5568, 5570, 5571, 5572, 5573, 5577
5579, 5582, 5597, 5612, 5613, 5615, 5618, 5634, 5647
5648, 5650, 5657, 5673, 5685, 5689, 5690, 5693, 5694
5703, 5707, 5708, 5713, 5731, 5732, 5734, 5735, 5747
5748, 5750, 5754, 5761, 5763, 5764, 5769, 5780, 5799
5815, 5821, 5822, 5823, 5834, 5835, 5846, 5859, 5860
5868, 5876, 5911, 5913, 5914, 5915, 5925, 5932, 5940
5943, 5947, 5949, 5950, 5951, 5961, 5973, 5975, 5984
6000, 6005, 6028, 6030, 6033, 6037, 6039, 6047, 6055
6062, 6063, 6072, 6073, 6076, 6081, 6108, 6109, 6111
6112, 6119, 6120, 6124, 6126, 6132, 6136, 6144, 6148
6159, 6162, 6163, 6164, 6165, 6166, 6168, 6169, 6171
6172, 6180, 6192, 6201, 6224, 6225, 6235, 6236, 6237
6241, 6250, 6251, 6253, 6256, 6257, 6262, 6267, 6271

SYNERGISM
6085,

TESTING FACILITIES
4947, 4950, 4959, 5017, 5071, 5381, 5383, 5475, 5529
5709, 5725, 5867, 5906, 5943, 5956, 6038, 6060, 6061
6069, 6070, 6079, 6135, 6139, 6140, 6143, 6147, 6171
6195, 6196, 6226,

TEXTILES
5033, 5213, 5869, 5934, 6035,

THERMODYNAMICS
4967, 5222, 5261, 5281, 5308, 5438, 5441, 5635, 5662
5669, 5674, 5675, 5692, 5705, 5711, 5713, 5730, 5732
5739, 5746, 5756, 5769, 5777, 5778, 5796, 5799, 5804
5812, 5820, 5828, 5834, 5835, 5859, 5882, 5894, 5913
5925, 5949, 5950, 5951, 5958, 5992, 5997, 6010, 6172

THIN-LAYER CHROMATOGRAPHY
5389, 5502, 5569,

THRESHOLDS
6085, 6139, 6143, 6191, 6242,

TOPOGRAPHIC INTERACTIONS
4940, 4953, 5551, 5586, 5616, 5617, 5622, 5625, 6206
6263,

TOXICITY
4987, 5239, 5413, 5430, 6026, 6030, 6032, 6042, 6048
6066, 6075, 6083, 6085, 6086, 6090, 6131, 6137, 6187
6197, 6198, 625C, 6267,

TRANSPORTATION
SEE ALSO: AIRCRAFT, GAS TURBINES, DIESEL ENGINES, SPARK
IGNITION ENGINES, VEHICLES
4930, 4947, 4959, 4972, 4977, 4978, 4984, 4990, 4991
5003, 5008, 5018, 5019, 5045, 5058, 5064, 5075, 5099
5109, 5127, 5159, 5188, 5210, 5238, 5290, 5293, 5303
5325, 5329, 5429, 5477, 5499, 5531, 5654, 5663, 5688
5772, 5778, 5877, 5904, 5922, 5970, 6237, 6249, 6263

TREES
4938, 4944, 5031, 5363, 5388, 5566, 5619, 6118, 6119
6127, 6133, 6136, 6144, 6152, 6154, 6180, 6206,

URBAN AREAS
4920, 4940, 4942, 4944, 4952, 4979, 4981, 4988, 4989
5034, 5087, 5161, 5361, 5367, 5389, 5412, 5443, 5461
5462, 5463, 5473, 5488, 5502, 5512, 5525, 5540, 5547
5548, 5550, 5552, 5557, 5558, 5560, 5561, 5562, 5564
5567, 5568, 5569, 5571, 5572, 5573, 5575, 5576, 5580
5581, 5585, 5597, 5601, 5606, 5611, 5615, 5617, 5622

5623, 5632, 5970, 6034, 6039, 6041, 6055, 6056, 6058
6062, 6063, 6068, 6072, 6078, 6080, 6091, 6092, 6093
6097, 6101, 6103, 6113, 6114, 6115, 6116, 6124, 6144
6154, 6156, 6157, 6166, 6192, 6194, 6206, 6217, 6234
6237, 6242, 6243, 6244, 6246, 6263, 6271,

VANADIUM COMPOUNDS
4937, 4952, 5017, 5032, 5113, 5138, 5139, 5241, 5303
5386, 5673, 5694, 5780, 5812, 5985,

VEGETABLES
5363, 5388, 6131, 6133, 6135, 6138, 6141, 6150, 6151
6153, 6154,

VEHICLES
4930, 4936, 4942, 4948, 4952, 4959, 4989, 5018, 5055
5076, 5092, 5150, 5162, 5176, 5214, 5329, 5425, 5472
5540, 5546, 5553, 5557, 5562, 5563, 5568, 5597, 5663
5970, 6077, 6185, 6195, 6233, 6249,

VISIBILITY
4960, 5590, 5591, 5592, 5594, 5617, 5621, 5681, 5788
5811, 5840, 6180, 6188, 6194,

ZINC COMPOUNDS
5067, 5119, 5133, 5134, 5733, 5900, 6005, 6031, 6133

AUTHOR INDEX

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AUTHOR INDEX

A

ABDEL HADY M C5457
ABEL E C5554
ABEL N C5633
ABEL N C5359
ABLE E C5565
ACHENBACH K C5248
ACHESON E D C5871
ACHTERFELD H C5455
ADACHI M C6115
ADACHI M C6114
ADACHI M C6113
ADADUROV I E C5634
ADAMS F A C6213
ADAMS M L C5360
ADAMSON A W C5635
ADNET J J C5724
AGAFONOV N N C5731
AGARKOVA N A C4995
AGARWAL M K C5361
AGARWAL M K C6096
AGATE J N C6026
AGENO H Y C5805
AGLIARDI N C4996
AHMED S M C5636
AILOR W H JR C6156
AKAGI M C5362
AKAGI M C4918
AKBRUT A I C4997
AKHMEDOV B K C6183
AKOPOV I E C6027
ALBERT H C5637
ALDAZ L C5479
ALDRICH E W 05706
ALEINIKOV G A C5307
ALEXJEEV B A C5638
ALIMARIN I P C5639
ALIYEV G M A C4998
ALLEN J A C5640
ALLEN J T C5475
AMBLER C M C5641
AMELIN A G C4999
AMMANN P R C5642
ANDERSEN H C C5000
ANDERSEN L B C5001
ANDERSON F K C6152
ANDO T C5268
ANDRIESE P C C6135
ANDRIESE P C C6069
ANGHEL P C5234
ANGUS W R C5657
ANTISARI O V C5643
ANTONINI E C5644
ANTONISHIN N V C5645
AOYAMA M C5572
APANASENKO M V C5634
APELBLAT A C5646
ARAKI Y C5192
ARAMAKI M C5002
ARII K C5647
ARII K C5648
ARIKADO H C6148
ARISTOV G Y C5729
ARITA S C5101
ARMENDARIZ M C5584
ARONSOHN A C5003
ARREGGER J E C5649
ASH R C5650
ASHLEY D J B C6029
ASHLEY D J B C6028
ASKIN D C5964
ASLING C W C6053
ASSEFF P A C6158
ASTARITA G C5651
ASTRUP P C6059
ASUKATA R C5173
ATKINSON R J C5652
ATROSHCHENKO V I C5653
ATSUKAWA M C5005
ATSUKAWA M C5004
AUSTIN H C C5006
AUTHIER R C4955
AYEN R J C5654
AYLMORE L A G C5655
AYRES S M C6030

B

BACCANARI S C6204
BACHOFER J L JR C5287
BADDOUR R F C5656
BADDOUR R F C5878
BAECHT W C5519
BAER C H C5363
BAER C H C6118
BAILEY C R C5657
BAIR E J C5967
BAKALINSKAYA E D C6031
BAKER B S C5008
BAKER D G C5585
BAKER H B C5341
BAKER W E C5658
BALAZS Z C4919
BANDO S C4993
BANKS E C5930
BARANOVA A I C4999
BARDSWICK W A C5364
BARKOV N N C5009

Preceding page blank

BARNEA M C4920
BARRER R M C5655
BARRER R M C5650
BARRER R M C5659
BARRER R M C5660
BARRET P C5754
BARRETT E C5586
BARRIE J A C5656
BARRIE J A C5883
BARRIE J A C5879
BARRY P J C5661
BARTHEL C E JR C6205
BARTHOLOMEW R F C5662
BARTMAN J S C5287
BARUSCH M R C5663
BASAK N C C6176
BASCOM R C C6196
BASS H E C6043
BASSETTI P C6244
BASU A N C6176
BATH T D C5539
BAUM F C5366
BAUM F C5367
BAUM W A C5587
BAUMANN R C5569
BAZHENOV V A C5604
BEAMS J W C5668
BEAMS J W C5664
BEAMS J W C5665
BEAMS J W C5666
BEAMS J W C5667
BEAN S L C4921
BEAU R C5152
BEAUSEIGNEUR G C5669
BECKER E W C5670
BECKER E W C5671
BECKMAN D L C6032
BECKMAN J W C5010
BEDOV I S C4995
BEENAKKER J J M C5672
BEGÜTTER F C5569
BELANGER W E C6033
BELEN KAYA I M C5673
BELL G H C6026
BELLE P C5629
BELTON W E C5693
BELZ R A C5988
BENARIE M C5368
BENDER R J C5774
BENDER R J C5064
BENES M C5369
BENNETT R R C5475
BENOLIEL J T A C6245
BENSON D C6061
BENT F A C5011
BERARD A P C5936
BERENYI L C5674
BERGMAN A G C5675
BERINCAN C C6206
BERLIN A C5676
BERMAN A S C5677
BERNE, B J C5678
BERNERT J C5370
BERRY E X C5905
BERTOZZI G C5680
BERTOZZI G C5679
BERTRAND R R C5015
BESTLEY B C5681
BETTA V C5016
BEVERIDGE G S G C4922
BEYER D L C5921
BEYERLE K C5797
BEYRICH W C5670
BHATTI W F C4923
BIENSTOCK D C5017
BIER K C5671
BIER K C5670
BIER K C C4924
BIERSTEKER K C6034
BIERSTEKER K C6246
BIERSTEKER K C6036
BIETH R C5786
BIKTIMIROV R S C5682
BILOUS O C5683
BILOUS O C5784
BILOUS O C5847
BILOUS O C6247
BIXLER H J C5878
BIXLER H J C5882
BIXLER H J C5881
BIXLER H J C5880
BIXLER H J C5656
BLACK G C6012
BLACK G C6013
BLAEDEL W J C5684
BLAPPLE K W C5188
BLANCHARD L C5685
BLASCHKE R C5474
BLOKKER P C C4925
BLUM L C5686
BLUNCK O C5371
BOCCACCIO S C5540
BOCCHINI M C5687
BOCKIAN A H C5588
BOCKRIS J O M C5688
BODDIE G F C6026
BODENSTEIN M C5689
BODENSTEIN M C5690
BODIN O C5368
BOERTITZ S C6119
BOETTGER O C5691
BOHLIG H C6035
BOIS A C5018
BOL SHAKOV K A C5692
BONAMASSA F C5588
BOND P A C5693
BONTE J C5749

BOOS A C5C19
BORESKOV G K C5694
BORESKOV G K C6C14
BORGES DA SILVA R C5825
BORIC R W C5C2C
BORODIN V A C5695
BORODULYA V A C5645
BOROK B A C5976
BOROK B A C5977
BOROZDINA L A C5313
BORS J C5372
BOSWELL M C C5C21
BOUBEL R W C4960
BOURELLY T C5541
BOVIER R F C5C22
BOWERS H C C5816
BOWIE W S C5265
BOWLER R G C6026
BOWMAN M R C5373
BOWNE N E C5553
BOYER A E C5589
BRADLEY J N C5696
BRAGINSKAYA R I C5C8C
BRAILE V V C6245
BRAMAN R S C5374
BRAND H D C5C23
BRANDT C S C5447
BRANDT J C5876
BRANDT W W C5697
BRANTNER H C6078
BRAS G H C5699
BRAS G H C5698
BRAUNSTEIN J C57CC
BRCIC B S C5701
BREDIG M A C5702
BRENNAN E C612C
BRETSCHNEIDER B C4926
BRETSCHNEIDER G C5248
BRETSZNAJDER S C5703
BREUER J C6043
BREUER M E C5704
BREWER L C5705
BREZHNEV B G C5896
BRICARD J C5614
BRIDGEMAN O C C5706
BRINDUE L C5234
BRINER E C5708
BRINER E C5707
BRINK J A JR C5025
BRINKMAN W C5709
BROCKE W C5026
BROCKHAUS A C5405
BRODIN G C5586
BRODOVICZ B A JR C5375
BROWN T S C59CC
BROWN W J C4936
BRUNAUER S C5376
BRUTON R C5027
BRYANT P M C5542
BRYNESTAD J C5711
BRYNZA A P C6159
BUCHANAN L M C5377
BUCKELL M C6026
BUCKMAN K E C5028
BUDDENHAGEN D A C5712
BUDELOT J P C5713
BUECHLER A C5714
BUGAYEV N F C4998
BUGRIM E D C5715
BULBA E C5378
BULLRICH K C5717
BULLRICH K C5716
BULLRICH K C559C
BULYGIN S F C5638
BUMGARNER L R C6074
BUMP R L C5029
BUNKIN F V C5718
BURCHSTED C A C5030
BUREMA L C6C36
BURGGRABE W F C5025
BURGHOFF H C5671
BURGHOFF H C567C
BURNETT R W C5719
BURNETT W E C5379
BURNETTE R D C5968
BURTON A H C5C28
BURTON D J C6184
BUSH A C6061
BUTTERFIELD N W C6123

C

CALAPAJ G G C4989
CALCIROLA P C5720
CAMPBELL F J C6123
CAMPBELL F J C6122
CANCELI A C5380
CANTUEL J C5749
CANZONERI N C5031
CAPETTI E C4965
CAPETTI E C4927
CARDUCCI C N C5454
CARETTO L S C4972
CARNICOM M L C5721
CARNOW B C6C37
CAROTTI A A C4981
CARPENTER S B C54C7
CARRISON P H C5032
CARTER J W C5722
CARTER J S C5888
CASSIE A B D C5657
CASTELLANO E C5723
CAULET T C5724
CECILIONI V A C61C6
CEJKA M C4928
CERNY G C5759
CHADWICK W L C5CC6
CHAIKA P A C5725

CHAPMAN S C5726
CHAPOUX F C5381
CHAPOUX F C6185
CHARBONNIER J C6071
CHARLSON R J C5591
CHARLSON R J C5597
CHARPIN J C5727
CHAYANOVA E A C5728
CHEESEMAN E A C6026
CHEN C C6038
CHERNOBROTOV E S C5638
CHERTKOV B A C5729
CHIPMAN J C5730
CHOO C Y C5878
CHOW T J C4961
CHUFAROV G I C5731
CHUNG K C C6039
CHZHI TSAYN S C5732
CLARK A J C5640
CLARK W T 05034
CLEMSON B C6207
CLIFTON M C5543
CLODI P P C5733
COBBS W H JR C5851
COBURN R F C6040
COCCIA G C5959
COCKETT G H C5681
COCKRELL C F C6248
COCKRELL C F C6270
COENEN W C5382
COFFMAN C K C6074
COLE R C5035
COLE T G C5306
COLEMAN R
COLLET A C6071
COLLINS J M C5592
COMTAT M C5734
CONSTANTINESCU M C5036
COOK D R C5593
COOPER W J C5308
CORBETT P F C5037
CORN M C6041
COSBY W T C5042
COSBY W T C5735
COULEHAN B A C5449
COUNAS G C5683
CRANE S C C6050
CRANE S C C6051
CRAWFORD G C5456
CREANGA L C5235
CRECELIUS H J C5401
CREER R A C6240
CRESWICK F A C5315
CRIDER W L C5383
CRIDER W L C4948
CRONAN C S C5736
CROSLEY D R C5737
CROSS F L JR C5040
CROSS F L JR C6208
CSIZEK I C5408
CUMMINGS J I C5794
CUNNINGHAM J C J C5738
CURRAN G P C5739
CVRK Z C5357

D

DAHLER J S C5740
DAHLGREN C M C5377
DAINES R H C6120
DALMAU GIMENEZ F C5741
DAMASCHKE K C5562
DANATOS S C5742
DANCKWERTS P V C5743
DANCKWERTS P V C5744
DANCKWERTS P V C5745
DANIELS F C5041
DANILOV A I C5385
DANTSIG M L C5134
DARBYSHIRE R W C5821
DAS H A C5386
DASS F C C6121
DAUBA J L C5746
DAVENPORT S J C6249
DAVIDOVSKIY G A C4997
DAVIDSON B C5747
DAVIES E C5042
DAVIGNON L C5914
DAVIGNON L C5911
DAVIGNON L C5915
DAVIGNON L C5913
DAVTYAN O K C5748
DAY A G III C5326
DE CORMIS L C5749
DE FILIPPI R P C5656
DE FORCRAND R C575C
DE GRAAF H C6C36
DE LA GARZA A C5751
DE LA GARZA A C5752
DE POMPEIS C C5547
DEAN K C C5043
DEAN P N C5899
DEBERRY C C5222
DEBRUN G C5387
DECKER H M C5377
DEDOLPH R R C615C
DEFORD D D 05753
DELAFOSSE D C5713
DELAFOSSE D C5754
DELWAIDE P C6042
DELYAGIN G N C5755
DEMBECK F C5C44
DEMMRICH H C5418
DENBIGH K G C5756
DENDA T C5268
DENDA T C4979
DENSEN P M C6043
DEPALMA T V C5C45

BERNDINGER H C C5047
BESBAUMES P C5388
BESTRIAU M C59C2
BETRIE J P C62C9
BEWALC D C6210
BEWOLF J B C5545
BICKSON D J C5757
BIDDAMS D G C6C21
BIEHL E K C5C49
BIETRICH F C5366
BIKUN P P C5389
BIMOV G C5952
BIMOV N P C5758
BIOMAIUTC BENNARD J C5759
BIOSZEGHY D C5760
BITYAKIN Y F C5695
BIYEV N P C5761
BIZMIER J C5784
BMITRIYEV M T C6186
BOBBINS R A C5390
BOBRE I C4965
BOBRE I C4927
BOCHERTY J C5549
BODONOVA N Y C5762
BOERRE W H C5391
BOERRE W H C6C44
BOIWA A C5763
BONTENWILL W C6046
BONTENWILL W C6045
BORMAN R G C5392
BORMAN R G C5C5C
BORTHE G C59C2
BOUGLAS A E C5764
BOUGLAS T H J C6026
BOWNS R J C6131
BOYLE G J C5529
BRATWA H C5C52
BRATWA H C5051
BRAVNIEKS A C5765
BRUETT H A C5766
BRUETT H A C6026
BRUILHET A C5614
BRY M E C5767
BUARDO J A C5393
BUBCIS A B C6047
BUCE R A C5555
BUCHENE J C5152
BUDEL H P C5594
BUDLEY A R C5053
BUFOUR L C5768
BUNKEN H C5769
BUNN C L C5C73
BUPREY R L C6235
BURRANT T C4929
BUUREN H V C5394
BWYER F C C5054

E

EBERAN EBERHORST RC5C55
EBERAN EBERHORST RC493C
EBERHARDT H C5056
EDWARDS F J C5057
EDWARDS G C5C58
EDWARDS T H C577C
EICHMEIER J C5771
EICHMEIER J C5546
EIDEN R C559C
EIDEN R C5717
EIDEN R C5716
EIDNER D C5C59
EKIN J W JR C5898
EL KADY F Y C5809
ELFERS L A C5415
ELIKAN L C5772
ELLERBE D R C6211
ELMENHORST H C6046
ELMENHORST H C6045
ELSHOBAKY G C5796
ELSHOLT A J C5394
EMEL YANOV YU M C5441
EMICH K H C5395
EMMETT P H C5773
EMMETT P H C5376
ENDERS K L C6187
ENGDAHL R B C6225
ENGDAHL R B C51C2
ENGELHARDT A G C5978
ENGELS L H C5C61
ENGLERT R D C5529
ENNAN A A C5324
ENNAN A A C5989
ENZ J W C5585
EPSTEIN S S C6083
ERGUN S C5873
ERGUN S C5872
ERMAKOV E V C6C48
ERTL D C5C63
ESCHELBACH G C5717
ESCHELBACH C C559C
ESCHELBACH G C5716
ESSENHIGH R H C5326
ESSENHIGH R H C5941
ESSENSON L C6212
EVANS'R K C5774
EVANS R K C5064
EVERHARD F L C5397
EYZAT P C5C65

F

FAESSLER K C6160
FAIGIN H C5588
FAINGOLD S G C4932
FAIRBAIRN A R C5775
FARMER W M C5988
FASCHING G E C5266
FAUST W J C5C98
FEATHERBY E A C61C7

FEDDERSEN C C5485
FEDER W A C6122
FEDER W A C6123
FEDORCV P I C5692
FEIN H L C5881
FELD W C5C67
FELDMAN J G C6098
FELDSTEIN M C6188
FELT A E C4936
FERGUSSON G J C5326
FERNANDES J H C5068
FERRIS B G JR C6C49
FIELD J F C5C17
FIELD P E C5776
FIELD S C5516
FIELDS W M C5069
FINCHAM C J B C5777
FINK C G C5689
FINK F C6161
FINNEY J A JR C5C7C
FIOCCO G C5545
FIRST M W C5398
FISCHER F C559C
FISCHER G C6078
FISCHER K C5717
FISCHER K C5716
FISCHER S C5778
FLACHSBART H C55C6
FLATTAU J C5399
FLETCHER B C5779
FLETCHER J C C5595
FLOOD H C5782
FLOOD H C5781
FLOOD H C5780
FLYNN G W C5783
FOLKERTS G C6138
FONES R E C5071
FONSECA M R M DE B C6245
FONTAN J C5614
FORCHERI S C5676
FORD D C5494
FORD H S C6196
FORISSIER M C5410
FORLAND T C5782
FORSTER R E C6040
FORTAK H C5596
FORTAK H C5400
FORWERG W C5401
FOSTER E G C5041
FOSTER K W C5798
FRACKIN G M C5896
FRANCIS W E C54C2
FRANCO P C5547
FRANKIEWICZ S C54C3
FRANKOWSKI J J C4924
FRANTZ R A JR C5867
FRANZ B C5C72
FRAUENFELDER A C4933
FREEDMAN R W C5449
FREEDMAN R W C54C4
FREEMAN G C6051
FREEMAN G C6050
FREILING E C C5946
FREITAS F R C5C73
FREJACQUES C C5784
FRENCH A S C5696
FRENKEL A I C5325
FREY D J C5785
FREYSZ L C5786
FRIEDLANDER H Z C5933
FRIEDLANDER S K C4934
FRIEDRICHS K H C5405
FRIEND J P C5597
FRISCHAUF H C5723
FRISCUE D E C5377
FRITSCH W H C5787
FRITZE E C6052
FRIZZOLA J A C5598
FROST A C C5015
FROST G C6053
FRYSINGER G R C5C75
FUJII M C6162
FUJII N C5508
FUJII N C55C9
FUJII S C6258
FUJII S C5C76
FUJII T C5077
FUJIKAWA F C6162
FUJISAWA G C5317
FUKUCHI T C5C78
FUKUI H C5470
FUKUI S C5C79
FULWEILER W H C5824
FURIOSI N J C6051
FURIOSI N J C6050

G

GABAY J J C54C6
GABRIEL K C5516
GAGLIARDI J C C4935
GALEANO S F C6213
GALUNSKI Z C5952
GANTCHEFF G S C625C
GANZ S N C5080
GANZ S N C5C81
GARDNER M C5182
GARRAD J C6026
GARRETT C A C5751
GARTNER I C6221
GARTRELL F E C54C7
GASKILL J R C5788
GAVLOVSKAYA S S C5232
GAZARYAN L M C5082
GEHMAN R P C5083
GELERNTER G C5941
GENSECKE W C5084
GEOGHEGAN G R H C5845

GEORGALIN R A C5324
GEORGALIN R A C5989
GEORGII H W C5548
GERTH G C5085
GHALEB H A C6057
GHANNAM F E C4935
GHEORGHIU T C4927
GHOSSEIRI J C5491
GIBBENS H R C6169
GIBSON A J C5373
GIBSON J A B C5549
GIESEKE J A C5315
GIETL W M C5086
GILBERT C L C6124
GILLETTE D G C6125
GIONA A R C5296
GIRDEN B B C5087
GITSAREV A I C4997
GLASSON W A C6060
GLENN R A C5088
GLUSHKOV V M C5789
GODIN J C6147
GOEBEL E C5204
GOGODETSKIY N I C5080
GOL DBERG M S C5089
GOLDBERG E C5308
GOLDSMITH J R C6054
GOLIC L C5701
GONCHARENKO G K C5653
GONIK A Y C4998
GONYOU D K C4924
GOODEVE C F C5090
GOOLD J C6107
GORDON I Z C5307
GORDON R C5678
GORIN E C5739
GOSSELIN A E JR C5091
GOTTAUF M C5790
GOTTLICH F J C5589
GOUBEAU J C5791
GRABOWSKI H A C5020
GRAFF R A C5281
GRAFTON R W C5792
GRAHAM J I C5793
GRAHAME D C C5794
GRANDILLO A D C5795
GRAVELLE P C C5796
GREENWELL L E C5025
GREER J S C5308
GRENINGER N B C5965
GRIGORESCU I C5408
GRIGORYAN G D C5837
GRIGORYAN G D C5836
GRIMOLDBY M R C5543
GRJOTHEIM K C5711
GROEZINGER H C5092
GROSS G P C5170
GROSS L J C5108
GROSSER P J C6251
GROSSKINSKY D C5086
GROSSMANN COOPER A C6252
GROSSO J J C6139
GROTH W E C5797
GROVE G R C5798
GRUEV K C5952
GRUEVA D C5952
GRUMER J C5965
GRUNT A C5182
GRUVER V S C6014
GUBCOVA A C5799
GUDERIAN R C6126
GUEHNE H C5093
GUENTHEROTH H C5800
GUEST E T C5094
GUETTICH R C6082
GUIBET J C C5065
GULYUK A M C5645
GUNDEL E C6052
GURVICH A S C5801
GUSAROV V N C4995
GUTTMAN H C6163
GUTTMAN H C6164
GUYOT G C5095
GVERDTSITELI L G C5802

H

HAAGEN SMIT A J C5096
HADZIJA C C5409
HAEFF A V C5712
HAENEL G C5716
HAENEL G C5717
HAENEL G C5803
HAENEL G C5590
HAENTZSCH S C5561
HAGENA D C5671
HAGENA D C5670
HAGMAN R E C5700
HAGOPIAN E C5804
HAJDUK J C6127
HAJDUK J C6128
HALA E C5859
HALE E A C5097
HALL C A C4936
HALL C R C5979
HALL F F JR C5805
HALLIDAY E C C5599
HALSAM R T C5806
HAMAMURA N C5550
HAMBLIN R J J C5098
HAMEL P C5807
HAMMERSCHMIDT F C5949
HAMMERSCHMIDT F C5950
HAMMJE K C5551
HANGEBRAUCK R P C5099
HANGEBRAUCK R P C5276
HANSEN D A C5529

HANSEN F V C5584
HANUS J C4939
HARADA A C5470
HARADA Y C5303
HARDEN D G C6102
HARITATOS N J C5100
HARKE H P C6046
HARKE H P C6045
HARNER F M C6151
HARNER F C6152
HARNEY T R C4937
HAROUN E A C6057
HARPER K T C5043
HARRINGTON G W C5819
HARRIS R D C5088
HARTMANN B C5808
HARTWELL R E C5397
HARVEY P D C5100
HARWOOD J L C5885
HASEBE S C5101
HASEGAWA A C4979
HASEGAWA Y C6055
HASEGAWA M C6056
HASHIMOTO M C6253
HASSAN H A C5809
HASSANEIN M C6057
HATANO S C5517
HATSUTORI T C6162
HATTERER A C5410
HATTORI H C5302
HATTORI M C5256
HATTORI S C6101
HATTORI T C6068
HAVENS R C5043
HAWTHORNE J N C5885
HAYASHI M C6068
HAYATA Y C6058
HAYES J V C5411
HAYNES F B C5668
HAZARD H R C5315
HECK W W C6129
HEGAZY M R C6057
HEGER K C5716
HEGER K C5717
HEGER K C5590
HEGGESTAD H E C6140
HEGGESTAD H E C6139
HEIN G M C5102
HEISE M C6172
HELLER A C5552
HELLER A C5412
HELLUNG L P C6059
HENDERSON R D C6196
HENDRICKSON W G C5041
HENLEY E J C5857
HENLEY E J C5856
HENRIKSSON S T C5150
HENSEL R P C5020
HERSCH P A C5414
HERSHEY R L C5806
HERZOG G C5103
HEUSGHEM C C6042
HEUSS J M C6060
HIBBEN C R C6130
HICKLING R C5810
HIDA K C6113
HIDA K C6115
HILL A C C6131
HILL H C5850
HILST G R C5553
HIRAI H C5303
HIRAI K C6162
HIRASAWA S C5301
HIRATA M C5256
HIRAYAMA T C6162
HIROMORI J C4993
HIROTA K C5908
HISAMURA T C5298
HISHINUMA Y C5298
HITCH B F C5105
HLUCHAN E C5554
HLUCHAN E C5565
HOBBS P V C4938
HOCHHEISER S C5415
HOCHREITER F C C5811
HOCKINGS W A C5416
HODEK J C5812
HODGKINS D J C5788
HODGKISS J E C5106
HODNETT N C5979
HOFFMAN C L C5555
HOFFMANN D C5417
HOFTIJZER P J C5844
HOGLUND R L C5751
HOHMANN H C5107
HOLDEN J H C5265
HOLLAND G J C6061
HOLLAND R P C6061
HOLLIDAY M C5813
HOLOBRADY K C4939
HOLTZBERG F C5930
HOLTZMAN R B C6150
HOLZHEY J C5418
HOOREN C J V C5844
HOOVER G M C5419
HOPFNER C C5724
HORAK H G C5600
HORIUTI J C5908
HORLACHER W R JR C5287
HORN K C5556
HORN K C6062
HOUGH G W C5108
HRABOWECKYJ M C5109
HUCK G C5086
HUENIGEN E C6189
HUKUI S C5110
HUME C N C5753

HUNT C M C5420
HUNTER D C6026
HURN R W C4958
HUYSMAN M C5111

I

IBRAHIM K C5112
ICHINOMIYA K C6162
ICHINOSAWA A C6063
IGUCHI M C5137
IINOYA K C5174
IINOYA K C5167
IINOYA K C5421
IKENO S C5891
IL INA N I C5692
ILJIN A I C6024
ILYASHENKO V N C5327
IMAISUMI T C5422
IMAMURA S C6064
IMANASHI T C4993
IMATAKE T C53C3
INARD A C5629
INGIULLA M C5540
INGRAM G C5113
INNES W B C5423
INOUYE R C56C1
INOUYE R C494C
ICFFE M S C5896
IRZHANOV S D C6065
ISHIDA A C6068
ISHII K C5891
ISHINISHI N C6092
ISHINISHI N C6093
ISHIZAKI T C5890
ISHIZUYA A C5349
ITO K C6115
ITO K C6113
ITO K C6114
IVANOV V N C5814
IVANOVA G Y C55C3
IVIN K J C5815
IWANOV D C5952
IXFELD H C5426

J

JACKSON H O C6153
JACKSON M R C5484
JACKSON M W C5114
JACOB M C5786
JACOBS G B C5816
JACOBSON M C54C4
JACQUEMAIN R C5557
JAEGER J C5427
JAEGER W C5115
JAFFE E H C6255
JAFS D C5116
JAIN F W DE C5117
JANDER G C5817
JAVAN A C5783
JEDLICKOVA H C4939
JEFFREY G A C5818
JELEN B C5118
JERMAN L C5428
JETTMAR V C5428
JINDAL H R C5819
JIRGLE J C5566
JIROUS F C582C
JOFFRIN J D C5754
JOHNSON J E C6CC7
JOHNSON J E C5429
JOHNSON K L C6241
JOHNSON W B JR C56C2
JOHNSTON W H C5326
JOHNSTONE H F C5CC1
JOHNSTONE H F C5120
JOHNSTONE H F C5119
JOHNSTONE H F C5821
JONAKIN J C5233
JONATHAN N C5822
JONDERKO G C6C66
JONES A H C5121
JONES A V C5823
JONES E W C6043
JONKMAN R M C5672
JORDAN C W C5824
JORDAN I C5825
JORDAN J C6015
JORDAN R C C5527
JORTNER J C5678
JOSEPH R L C5826
JOST D C5603
JUDES C C5786
JUENTGEN H C5C86
JUHASZ A C4919
JUNGE C C5359
JUNGE C C5633
JUNGREIS E C5430
JUNTGEN H C5145
JUTZI W C5431

K

KABANOV M V C5536
KABRIN L A C5358
KADOMA M C6162
KAGAN Y C5828
KAGAN Y C5827
KAGAN Y S C6191
KAHL H C55C4
KAHL H C5558
KAIHO S C4993
KAISER E R C4941
KAJI S C4993
KAJIMOTO M C55C8
KAJIMOTO M C55C9
KAKITA S C6C67
KALINOWSKI B C5829
KAMEGAYA H C5362

KAMEKO E C5122
KAMINO Y C5123
KAMIYAMA H C5124
KAMMERMEYER K C5704
KAMMERMEYER K C5830
KAMMERMEYER K C5929
KAMMERMEYER K C5832
KAMMERMEYER K C5831
KAMMERMEYER K C5833
KAMO S C5124
KAMPF W D C4942
KAMPHAUS H C5455
KANAGAWA A C5983
KANO S C4988
KANUKOV E K C5125
KAPUSTINKSY A F C5834
KAPUSTINSKIY A F C5835
KARAKHANYAN S S C5836
KARAKHANYAN S S C5837
KARAPETYAN R V C5718
KARCHMER J H C5838
KARLOV N V C5839
KARSTEN O C5126
KASPAR J C6254
KASUGA H C6113
KASUGA H C6115
KATELL S C5127
KATO K C5511
KATZ M C6132
KAWAGISHI T C6081
KAWAGUCHI H C6162
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KAWAMURA Y C5123
KAWASHIMA T C5173
KAWECKI W C5703
KAYLOR F B C5589
KEEN R H C5806
KEIR H M C5897
KELLY H J C5987
KEMENY E C5599
KENG E Y H C5840
KENYA A C5128
KERCHER H C5130
KERCHER H
KERNAN J J C5131
KERR H D C6097
KERR J C5132
KETTNER H C5412
KETTNER H C5434
KETTNER H C5433
KETTNER H C5432
KETTNER H C5552
KHAR KOVSKAYA Y N C5134
KHAR KOVSKAYA Y N C5133
KHARITONOVA S S C5559
KHAYYAL M A H C6057
KIJIMA H C5135
KIMHI Y C5841
KIMURA K C5435
KIMURA K C5436
KING W H JR C5437
KIPUT N S C4932
KISS A B C5438
KISTLER R C6221
KITABATAKE M C6081
KITAGAWA T C5439
KITAHARA S C5422
KITTREDGE G C C5099
KITTS A P C5232
KIYOURA R C5136
KIYOURA R C5138
KIYOURA R C5137
KIYOURA R C5139
KIYOURA R C5141
KIYOURA R C514C
KJELDSEN K C6059
KLAINER S M C5440
KLEIN H P C6268
KLEMAN B C5808
KLEPPA O J C5780
KLIMISCH R L C5842
KLINKSIEK K E C4943
KLOSTERLAUSITZ B C5485
KLYACHKO L A C5695
KNAAP H F P C5672
KNABE W C4944
KNAUER A C5391
KNAUER A C5556
KNIPOVICH O M C5441
KNOTKOVA CERNAKOVA O C6165
KOBAYASHI Y C6166
KOBAYASHI J C6133
KOBAYASHI Y C5442
KODAMA T C6068
KODAMA Y C6092
KODAMA Y C6093
KOERNER H J C5443
KOESTLER O C5444
KOJOHAROVA M C5952
KOJIMA H C5624
KOKURIN A O C5843
KOLAR J C5560
KOLB H C5791
KOLBE W C5825
KOLGANOV V A C5240
KOLYADICH M N C5445
KOMAR E G C6024
KOMAROVSKII M S C5327
KOMATSU M C4979
KONDO H C5143
KONDO M C5470
KONDO T C55C9
KONDO T C55C8
KONDRAT EVA T G C5134
KONISHI M C5192
KONOPINSKI V J C6077
KONVALINKA J A C5955

KORCTAYEV M M C6134
KOSZALKA M F C4923
KOTAKA S C6135
KOTAKA S C6070
KOTAKA S C6069
KOTOWSKA W C57C3
KOVACS M A C5783
KOYAMA Y C5268
KOZYREV B P C5604
KRALL H C C5791
KREVELEN D W V C5844
KRICHEVSKAYA E L C5989
KRICHEVSKAYA E L C5324
KRIJGSMAN M C5144
KROHN C C5711
KRONBERGER H C5845
KROTOSZYNSKI B K C5765
KRUEGER A P C6135
KRUEGER A P C6C7C
KRUEGER A P C6C69
KRUEL M C5145
KRUSHINSKAYA G K C5230
KRUSHINSKAYA G K C5227
KRYNITSKY J A C5146
KRYSENKO N S C5846
KUBO M C6115
KUBO M C6113
KUBO M C6114
KUBOYAMA T C5124
KUCERA J C5566
KUCHEROV R Y C58C2
KUCHERYAVYI E N C5327
KUDRYAVAYA N A C53C7
KUHLMANN A C5147
KUHLTHAU A R C5666
KUL PINA K I C5731
KULIK A A C5194
KUMAI M C4946
KUMAI M C5605
KUNITAKE E C6C92
KUNITAKE E C6C93
KURAMOCHI K C5148
KURFURST J C5446
KURITA S C5198
KURMEIER F F C5149
KURONUMA H C514C
KURONUMA H C5141
KURONUMA H C5139
KURONUMA H C5138
KURTZ F E C6167
KUSTOV V V C6134
KUTSUMA J C5213
KUWAJIMA T C6166
KUZ MIN G P C5839
KUZNETSOV I Y C5C81

L

L A RODINA C5125
LACY J C6074
LAFUMA J C6071
LAGRANGE P C5847
LAHIRI A C6176
LAHMANN E C5563
LAHMANN E C5562
LAHMANN E C5561
LAMPADIUS F C6136
LAMPE F W C5326
LANCASTER J E C6137
LAND J S C5183
LANDAU E C5447
LANDEBORG L E C515C
LANDEN E W C4947
LANDWEHR M C5448
LANG H W C5449
LANG H W C54C4
LANGE H C5848
LANGEMANN H C5849
LANGMEAD W A C5450
LARGE L N C5850
LARSEN R I C6077
LARSON G P C5346
LASOSKI S W JR C5851
LATSKY C E C6193
LAUER K F C5151
LAURSEN T C6059
LAVROV N V C5852
LAWRASON G C C4959
LAZAREV K A C6C22
LE PAGE M C5152
LEACH S J C5779
LEAHY T E C5451
LEBOVITS A C5853
LEDUC E C C6222
LEDUC E C C6220
LEDUC E C C6231
LEDUC E C C6221
LEE G C5153
LEE K M C6039
LEE R C C5154
LEE R E JR C4948
LEE S H C6C39
LEFEVRE G C6071
LEGNER M C6223
LEHMANN E C5564
LEIB F C6160
LEMAISTRE C A C5867
LENTINI A D C56C6
LEONARD J W C6270
LEONARD J W C6248
LEONARD J W C5C20
LEONE I C612C
LESNIK G E C56C7
LESSING R C5155
LEUTHEUSSER H J C4953
LEVA M C5854
LEVENETS N P C4949
LEVIN S A C6177

LEVISON H C6107
LEVY A C4950
LEWIS D J C5153
LEWIS J L C5183
LEWIS W K C5855
LEYKIN L I C5081
LI N N C5857
LI N N C5856
LIDDELL H F C5452
LIEB J H C6255
LIEBERMAN A C5484
LIEBSCHER P C5556
LIEDMEIER G P C4951
LIN Z F C5928
LINDBERG W C6072
LINDBERG W C4952
LINDNER K H C5858
LINDVALL T C6242
LINEK J C5859
LIPANOVA G A C5CC9
LIPPINCOTT E R C5860
LISOVSKIY O I C5846
LISOWSKI Z C5861
LITTAUER U Z C5841
LITTLEJOHN R F C5037
LIU V C C5862
LIU V C C5863
LIVINGSTON R S C5865
LIVINGSTON R S C5864
LLOYD A B C5608
LOCATELLI J D C4938
LOCKHART L B JR C5942
LOCKLIN D W C5315
LOEFFLER F C5866
LOHSE P C5671
LOHSE P C5670
LOKSHIN M A C5C8C
LONG R B C5856
LOPUKHOV G A C4949
LORD G R C4953
LOUDON R G C6074
LOUDON R G C5867
LUCAS H F JR C615C
LUDWIG E C6052
LUDWIG J H C5158
LUEBKE M C5562
LUGROVA C C5427
LUIS P C5454
LUK YANCHIKOV V S C5286
LUMIARO P C5159
LUNCHE R G C516C
LUND L M C5677
LUNDSTROM F C C5997
LUNGE G H C57C8
LUOMANMAKI K J C6C4C
LYNCH J C6184
LYUTYI A I C5715

M

MAASSEN A C5161
MAATSCH J C5455
MACARTHUR C A C4922
MACFARLANE W C5868
MACHE A C4955
MACLEAN D C C6138
MACPHERSON J H C5663
MACTAGGART E F C5163
MACUCH P C5565
MACZKA D C6025
MAGIE W A C5164
MAHENC J C5734
MAHER J L C5165
MAHER J L C5166
MAIDMENT B J C5923
MAIGOV I V C5358
MAIWALD E C5485
MAJUMDAR A R C5115
MAKHTESYAN I M C5836
MAKINO K C5421
MAKINO K C5167
MAKITA J C6162
MAKOV B N C5896
MAKSIMOV L A C5827
MAKSIMOV L C5828
MAKSIMOV L A C5887
MALECHA J C5369
MALECHOVA M C5369
MAMATOV A D C5358
MANAKIN B A C5748
MANAKIN G A C5989
MANAKIN G A C5324
MANCUSO T F C6075
MANDEL P C5786
MANDERSLOOT W G C5236
MANDRIOLI P C5468
MANNY E H C5269
MANTANI Y C6162
MARIA G C4956
MARKANT H P C5168
MARKUS G A C4957
MARSH A C5169
MARSHALL W F C4958
MARSHALLA A C5456
MARTIN E G C5C83
MARTIN F C6CC5
MARTIN J A C5865
MARTIN J A C5864
MARTIN J R C5233
MARTY G C5796
MARUYA H C6243
MARX B S C5193
MASAYUKI I C6081
MASCANZONI A C5687
MASLENNIKOVA J N C4999
MASON E A C5894
MASSA V F C517C
MASSIGNON D C5784

MASUDA S C6068
MASUDA S C5171
MASUDA Y C5417
MATALUCCI R V C5457
MATERNA J C5566
MATSUDA T C6224
MATSUI H C6064
MATSUMOTO K C5173
MATSUMOTO T C5172
MATSUMURA T C5581
MATSUMURA T C5533
MATSUMURA T C5580
MATSUMURA Y C6076
MATSUNO K C5174
MATSUYAMA Y C6162
MATSUZAWA T C6166
MATTHEWS K J C5870
MAUBON A C5111
MAURA G C5175
MAUSS M F C6168
MAUSTELLER J W C5482
MAYER J C5554
MAYER J C5565
MAYER R A C5609
MAYER W C5056
MAYYASI A M C6102
MCCALL M G C5871
MCCANN R J C5811
MCCARTHY J F C5458
MCCARTNEY J T C5873
MCCARTNEY E J C5610
MCCARTNEY J T C5872
MCCARTY B C5176
MCCLUSKEY S B C5177
MCCURDY C B C5998
MCDUFFIE H F C5105
MCELROY J L C5611
MCFEE J H C5919
MCKAY H A C C5612
MCKEE H C C4959
MCKEE H C C6194
MCLOUTH B F C5178
MCMULLAN R K C5818
MEAKIN J C C5874
MEDNIKOV Y P C5875
MEEKER J E C5502
MEIER ZU KOECKER H C5876
MEIJER R J C5877
MEITES L C5179
MEL NIKOVA L V C5518
MELAND B R C4960
MELESHKO G I C6134
MENES F C5676
MENSER H A C6140
MENSER H A JR C6139
MENYAKIN E S C5180
MERENKOV P T C5194
MERGENTHALER H C5181
MERZ A R C5997
MEYER E C5613
MEYER E C6256
MEYER R C6195
MEYERS R A C5182
MEYERS R A C5183
MEYTIN L M C4998
MICHAELS A S C5881
MICHAELS A S C5880
MICHAELS A S C5883
MICHAELS A S C5879
MICHAELS A S C5882
MICHAELS A S C5878
MICHAELS A S C5656
MICHAILOVA E A C5884
MICHELL R H C5885
MIESCHER E C5886
MIKHAILOVA YU V C5887
MIKHAYLOV V I C6134
MILDH G C5184
MILHAU A C5614
MILLER E B C5185
MILLER G W C6155
MILLER R L C5626
MILLER S A C5888
MILLER S E C4950
MILLER V C4963
MILLS K C C6196
MINCK R W C5889
MINODA Y C5186
MIRANDA J M C6077
MISYUK E G C5748
MITCHELL R C5494
MIYAJI M C5123
MIYAJIMA K C5301
MIYAMOTO T C5890
MIYAZAKI M C4993
MIZUNO K C5890
MIZUSHINA T C5891
MIZUTA I C5517
MNUSKIN I P C6159
MOELLER C C5893
MOESE J R C6078
MOLES O W C5958
MOMMEJAC S C5727
MONCHIK L C5894
MONFRINI C C5676
MONKMAN J L C5460
MONNIER R C5707
MOONEY J J C5188
MOORE C B C6009
MORAIN W A C5895
MORDELL J S C6075
MORGAN M J C5502
MORGAN W K C C6097
MORGIS G G C6249
MORI T C5135
MORII F C6133
MORIKAWA Y C6011

MORIMURA Y C6101
MORozov P M C5896
MOROZOVA Z I C5976
MOROZOVA Z I C5977
MORozzi C C5380
MORRIS J P C5772
MORRISON J M C5897
MORROW J I C5519
MORUZZI J L C5898
MOSES H C5461
MOSHER W E C6098
MOSS R L C6169
MOTOMIYA K C6113
MOTOMIYA K C6115
MOTOMIYA K C6114
MOTONAGA H C5189
MOULTON D G C6079
MUCSKAI L C5190
MUELLER C C6052
MUELLER H C C6052
MUELLER H C6257
MUERMANN H C5191
MUKAI S C5192
MUKERJI K G C5361
MUKHERJEE D K C6176
MULLANEY P F C5899
MUNIDASA M C5136
MUOTKA R L C5150
MURAI Y C5572
MURAKAMI Y C4993
MURAMOTO S C6133
MURASHOV B F C6048
MURCZUMI M C4961
MURRAY F E C5218
MURRAY J A C59CC
MUSCHTER W C5558
MUTER R B C6248
MYERS J C C5017
MYRICK R C5193
MYSLIVECEK J C5369

N

NABIYEV M K C5194
NAGAI H C5195
NAGATA M C5512
NAGATA M C5576
NAGATA M C5901
NAGIRA T C6243
NAITO J C6258
NAKAGAWA S C5196
NAKAGAWA K C5349
NAKAI Y C5197
NAKAJIMA S C4940
NAKAJIMA T C6038
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NAKAMURA H C5198
NAKAMURA H C6162
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NAKANO K C5421
NAKANO M C5462
NAKANO M C5463
NAKANO M C5567
NAKASHIMA S C6133
NANJO M C4988
NANN E C5797
NAOI Y C5199
NARITA G C5615
NASTASE C C4965
NASTASE C C4927
NAVALLES H C59C2
NELSON E E C52C0
NELSON G O C59C3
NELSON H W C6225
NELSON M M C6053
NEMEC L C5464
NEMKOVICH V A C5645
NENOT J C C6071
NEUMAN G E C52C3
NEUMANN B C5204
NEWHALL H K C4983
NEWMAN D J C52C5
NICOLAS PRAT C C5759
NIEDRACH L W C5904
NIELSEN B C C5631
NIELSEN K W C59C5
NIESSEN W R C62C2
NIETRUCH F C5466
NILES F E C59C6
NISHIDA K C5268
NISHIDA K C4979
NISHIKAWA M C6068
NISHIMOTO Y C5CC5
NISHIMURA H C5206
NISHIMURA S C6166
NISHINO K C52C7
NISHIYAMA K C55C8
NISHIZAKI S C5198
NITSURE H C5467
NIWA T C53C3
NOGOYEV K C5675
NOIRFALISE A C6042
NOLAN M C5456
NOMIYAMA K C6064
NONOYAMA J C6116
NORSWORTHY J R C6178
NORTON S G C6179
NOSTITZ WALLWITZ R VON C52C8
NOVIKOV A I C5229
NOVIKOV A I C5228
NUCCIOTTI F C5468

O

O CONNOR D T C545C
O DONNELL H J C5873
O HARA M J C52C9
O NEILL W E C5449

OBA H C6226
OBLANDER K C521C
OCHS H J C5212
OCHS H J C5211
ODAIRA T C6259
ODAIRA T C5568
ODAJIMA T C5943
ODOY SULE E C5516
OELSCHLAEGER W C59C7
OGIWARA I C59C1
OHIRA M C6243
OHIRA T C5213
OHMORI K C611C
OHNO C C5213
OHNUKI A C5962
OHO K C6058
OHYA M C5214
OKAI M C4918
OKAI M C5362
OKAMOTO G C59C8
OKAMOTO K C6038
OKAMOTO Y C608C
OKAZAK K C6162
OKITA T C5469
OKUNO T C5215
OKUTANI H C547C
OLARU C C4965
OLCOTT T M C5216
OLDRIGHT C L C4963
OLDS F C C6227
OLESOV N A C5217
OLEVINSKIY M I C5254
OLMSTED L M C6260
OLOMAN C C5218
OMURA A C5422
ONIZUKA S C5123
OOEDA J C6113
OOEDA J C6115
ORATOVSKII V I C4957
ORDIN L C6141
ORELL S R C6082
ORLOVA L M C5634
OROPEZA E C522C
OROPEZA V E C5220
ORR C JR C584C
ORTON R C5616
OSBORN K R C6261
OSHIMA H C6081
OSHIMA S C589C
OSHIO T C6262
OSHIO T C4964
OSHMA H C6116
OSINA S A C5445
OSUEGAWA I C52C6
OSTER G C5712
OSTER G K C5712
OSTROUMOV A I C6027
OTA Y C5471
OTOMURA K C5192
OTTO H C5444
OTTO H C6082
OWEN L E C59C9
OYA M C53C1
OYAMA Y C5983
OZERSKII Y G C4957

P

PACK C H C591C
PACK J L C5978
PACK M R C6131
PADRTA F G C5459
PADUCHEV V V C5761
PADVA V Y C5322
PAGANINI C C6228
PAGNOTTO L C C6083
PAILER M C5569
PALEARI C C5221
PALLANSCH M J C6167
PANASENKO N A C4985
PANIN B A C5638
PANNETIER G C5914
PANNETIER G C5911
PANNETIER G C5913
PANNETIER G C5912
PANNETIER G C5915
PANOIU N C5916
PARRISH E M C618C
PARRY E C5681
PARSONS T C5222
PATEL C K N C5919
PATERSON N J C5223
PATTERSON C C4961
PATTERSON R K C4948
PATTERSON R L JR C5942
PAULSON J F C592C
PAULUS H J C5585
PAULUS H J C5178
PEARL I A C5921
PEKLO P C6187
PELL M C5281
PELLE W J JR C6263
PENNY H R C5472
PEREZHOGIN G A C5639
PERGA M W C5045
PEROV Y V C5224
PERRY C A C5968
PERRY K M A C6026
PERSSON G C6264
PERY G C5646
PESENDORFER F C5733
PETERNEL P C57C1
PETERS K H C5473
PETERS M S C5654
PETERSEN B C6052
PETERSON E K C6142
PETERSON J T C5617

PETERSON C M C5527
PETO S C5923
PETROLL J C5225
PETROV YU N C5839
PETZOLD D C5226
PFEFFERKORN G C5474
PHELPS A V C5898
PHELPS A V C5978
PHILLIPS N D C5168
PHILLIPS T R C5486
PHILLIPS C R C5377
PHILLIPS G B C6265
PICKERING J E C6265
PIKE D E C5338
PINAEV V A C5227
PINAYEV V A C5228
PINAYEV V A C5229
PINAYEV V A C5230
PINGEL H C5691
PINSKY H C5588
PIRLET G C5231
PITELINA N P C5230
PITELINA N P C5229
PITELINA N P C5228
PLATON E C5036
PLEASANTS J R C6087
PLEKHOTKIN V F C5232
PLIGUNOV V P C5694
PLUMLEY A L C5233
PLURIEN P C5727
PLURIEN P C5784
PODLAHA M C5570
POETZL K C6084
POGOSYAN L G C6085
POKHITONOV Y P C5385
POLGAR I C5571
POLSTER L C5444
POMORSKI J C6025
POPE C G C5650
POPE D C6169
POPE F R S C5650
POPESCO I G C4927
POPESCO I G C4965
POPESCU C C6266
POPKOVICH G A C6010
POPOV V A C6019
POPOVICI N C5234
POSNER A M C5652
POTH M A C5794
POTOP P C5234
POTOP P C5235
POWELL K C6040
PRADO F G C5308
PRESCHER K E C5466
PRETORIUS S T C5236
PRICE H E C6143
PRIETSCH W C6189
PRINCI F C6086
PRODI V C5643
PROKHOROV A M C5718
PROKHOROV A M C5839
PRONINA R N C5134
PRONINA R N C5133
PUKLINA D L C5729
PURCELL R F C5475
PURSALL B R C4966
PYATIGORSKII A N C5307

Q

QUIRK J P C5652

R

RAAEN H P C5476
RABSON S R C5239
RADCZEWSKI C E C5924
RADO W G C5889
RADUSHKEVICH L V C5240
RAHMEL A C5925
RAMACIOTTI D C5388
RAMAN A K S C5241
RAMIREZ MUNOZ J C5926
RASMUSSEN R K C6268
RASSBACH W C5947
RASTORGUYEVA A V C5927
RATHGEBER F C5243
RATHGEBER F C5242
RAUB E C5951
RAUSA G C4989
RAYNOR G S C5619
REALE F C5016
RECHNITZ G A C5928
RECKNER L R C5477
RECKZEH G C6046
RECKZEH G C6045
REDDY B S C6087
REED C F C6099
REED E C6043
REED E F C5121
REEDS J N C5929
REES R L C5244
REGENBERG F C5478
REGENER V H C5479
REH L C4967
REISMAN A C5930
REITER R C6089
REITER R C5620
REITER R C5931
REITER R C6088
REMY BILLON M C C5557
REMY F C5557
REMY H C5932
RENZANIGO F C5221
REUBEN B C5813
REZNICHENKO R D C6159
RHINE P E C5480
RHODES C K C5783
RIBEIRO A C6245

RICCA P M C5245
RICH G Q C6061
RICHARDS J E C5549
RICHARDSON F D C5777
RICHARDSON J D C6026
RICKLES R N C5933
RIDER L J C5584
RIEDERS F C5979
RIGDEN J D C5893
RILEY M W C5934
RIMBERG D C5246
RIOU P C5936
RISK J B C5218
RITTIG J C5444
ROARK O F
ROBERTS A J C5178
ROBIN M A C5481
ROBINSON G D C5621
RODGERS S J C5482
RODRIGUES J C6245
ROEBISCH G C5483
ROGERS C E C5937
ROGERS E C5938
ROGGENDORF A C4968
ROHR F W C5247
ROKUSHIKA I C5572
ROMANEK W C5484
RONN A M C5939
ROSE E F C6090
ROSE V E C6184
ROSELIUS R R C5223
ROSS H C6108
ROSS K C4969
ROSS R G C5105
ROSS R W C5040
ROSS R W C6208
ROSSI G C5720
ROSSIKHIN V S C5715
ROTHE W C5248
ROTTIG W C5249
ROWDEN E C617C
ROY A J C5487
ROYALL H J C6091
ROZHNYATOVSKII I I C5327
RUEGER G C5485
RUHLAND K C5932
RUPPRECHT W E C5486
RUTZ L O C5831
RYABCHENKO A I C5634
RYASON P R C5252
RYASON P R C5251
RYCZAK S J C6181
RYNSKAYA E S C6159
RYSS M A C4995

S

SA A C5454
SACCO J C6230
SACCO J C6221
SACCO J F C6231
SADOWSKI F C6171
SAEMUNDSSON H B C5253
SAFIULLIN N S C5254
SAGE B H C5938
SAIGO M C6166
SAITO T C5255
SAITO Y C6058
SAITOH T C5256
SAKABE C C53C1
SAKAI T C497C
SAKUMA J C5198
SAKUMOTO Y C53C3
SALEH J M C594C
SALLEE E D C4971
SAMARIN A M C4949
SAMSON P C C5459
SAMUEL T C6172
SANDERS W J C5826
SANDERSON J G C5467
SANDFORD M C W C5373
SANDRI G C5468
SANKER P E C5987
SANO I C5488
SANOTSKY I V C6158
SANTOMAURO L C5622
SAPP J E C5C71
SARUTA N C6C93
SARUTA N C6C92
SASA M C589C
SASAKI S C59C1
SATHER N F C574C
SATO Y C5349
SATORI H C5198
SATYANARAYANA R T R C5941
SAUNDERS A W JR C5942
SAVEL EV B A C5536
SAWATANI T C5943
SAWATARI M C6162
SAWICKI C R C549C
SAWICKI E C5489
SAWICKI E C549C
SAWYER R F C4972
SAX N I C54C6
SAXENA S C C5945
SAXENA S C C5944
SAXENA V K C5945
SAXENA V K C5944
SAYER W J C5491
SCHEDLING J A C5569
SCHEDLING J A C6269
SCHEIDT R C C5946
SCHENCK R C5951
SCHENCK R C595C
SCHENCK R C5949
SCHENCK R C5948
SCHENCK R C5947
SCHERMEISTER L J C4923

SCHILLER C C5551
SCHISCHKOV D C5952
SCHLESINGER E R C6098
SCHMIDT A C5257
SCHMIDT E C6005
SCHMIDT K H C5258
SCHMIDT C P C6094
SCHNABEL W C5953
SCHNACK H C5733
SCHNEIDER R E C6138
SCHNEIDER W C5259
SCHNEIDER W C5492
SCHOEFFMANN E C5259
SCHOEN R I C5954
SCHOENBAECHLER M C5623
SCHOENHOFEN L H C6182
SCHOENING M A C4973
SCHOLLMAYER H C5590
SCHOLLMAYER H C5717
SCHOLLMAYER H C5716
SCHRADER R 05261
SCHRADER K C5260
SCHREIBER E C5493
SCHROEDER G D C5222
SCHUETTE R C5956
SCHUETTE R C5671
SCHUETTE R C5670
SCHUFTAN P M C5957
SCHUHMANN R JR C5958
SCHULER R E C6225
SCHULZ J F C5262
SCHULZE H C C5573
SCHUMACHER H J C5723
SCHUSCHKE G C5573
SCHWANECKE R C5263
SCHWARZ C C5264
SCHWARZ S E C6006
SCOFIELD F C4974
SCOFIELD F C495C
SCOLES G C5672
SCOTT D H C6211
SCOTT D H C498C
SCOTT W M C4975
SEDASHEVA S G C5653
SEGUIN R L C6173
SEHNALEK F C5759
SEIDEL D C5956
SEIDL W C4976
SEINFELD J H C4934
SEKI T C6144
SEKIKAWA T C5624
SELMAN R L C6167
SENSENBRENNER M C5786
SEREDA P J C6164
SERRAVALLE G C5959
SERVUS S C5357
SHABAD L M C6095
SHAFER H E JR C627C
SHAFFER J H C5776
SHAH I S C5168
SHALE C C C5265
SHALE C C C5266
SHARP A J C5543
SHAW J H C5494
SHAW M C5496
SHAW M C5495
SHEAN D B C5491
SHELEF M C5960
SHEPELEV Y Y C6134
SHIBUYA T C4978
SHIBUYA T C4977
SHIFRIN K S C5728
SHILHAN M J C6225
SHIMA S C5470
SHIMIZU T C6063
SHIMIZU T C6233
SHINADA T C5962
SHINAGAWA H C6080
SHIOZAKI T C5901
SHIRAI J C6080
SHIRASAKI E C5255
SHIVPURI D N C5361
SHIVPURI D N C6096
SHKARIN A V C5981
SHLIFER V A C5081
SHOHEPKIN G J C5638
SHOJI H C5268
SHOJI H C4979
SHTERN V Y C5963
SHULESHOV E I C5327
SHULMAN H L C5035
SIECKE W C5084
SIEGMUND C W C5269
SIEH R H W C5497
SIFTAR J C57C1
SILTANEN E C5498
SIMECEK J C5498
SIMONIN J C C5271
SIMPSON M H C5964
SINGER J M C5965
SINGER J G C5233
SINGHAL R K C5272
SKALA H C5499
SKARSTROM C C5667
SKATSCHE O C5493
SKOPP A C5015
SKYE E C6145
SLADE D H C5625
SLANGER T G C6012
SLANGER T G C6013
SLAVGORODSKAYA N P C5327
SLINN W G N C5966
SMIRNOV V I C5732
SMITH C R C5735
SMITH D B C6211
SMITH D B C4980
SMITH G F C5712

SMITH R A C4981
SMITH R C C6199
SMITH R I C4982
SMITH T B C5626
SMITH W C C5429
SMOLIK J C5273
SMYSLOV N I C5274
SNELLING D R C5967
SNICER D C5494
SNODDY L B C5666
SNOW B D C5968
SNYDERMAN J S C5326
SOBOLEV V V C5762
SOLBERG E D C6234
SOONG A L C5969
SORENSON S C C4983
SOSEKINA G V C5230
SOSEKINA G V C5228
SOSEKINA G V C5229
SPAEHN H C616C
SPAITE P W C5276
SPEKTORSKII V N C5481
SPERANSKY C5279
SPERANSKY R C5277
SPERANSKY R C5278
SPICER W S JR C6C97
SPINDT R S C4984
SPURNY K C55C0
SQUIRES A M C5281
SQUIRES A M C5280
SQUIRES A M C5282
SRYVALIN I T C5732
STABENOW G C5283
STACY W O C5284
STADLER L C6046
STADLER L C6045
STANDIFORD N E C6C97
STANETSKAYA A M C4932
STANLEY T W C55C2
STARKE E P C5358
STARKMAN E S C4972
STARSHOV I M C55C3
STAUBING P C5285
STAUFFER J L C5714
STEBLIY K T C4985
STEGER E C55C4
STEIMEL K C5970
STEIN G C C5971
STEINER W A C5336
STEINHORST G C559C
STEINHORST G C5717
STEINHORST G C5716
STEINKE I C55C5
STEPHENS R J C6C5C
STEVENS C R C4984
STEWART W S C5574
STEZHENSKIY A I C5286
STITES J G JR C5287
STOEBER W C55C6
STOECKL W C6146
STOLOT S M C5519
STORCH O C5288
STOREY P B C6C97
STORP K C5289
STOTZKY G C6130
STOUFF M L C4986
STRADER C S C529C
STRANO L C C539C
STRANCE J P C55C7
STRAUBEL M C5972
STRAUSS S D C5774
STRAUSS S C C5C64
STRAUSS W C5291
STREET O E C614C
STREICHER J S C5973
STRIMBECK G R C5265
STRNAD J C5974
STROHL J M C5684
STUBBS C M C5975
STUMPH T L C6235
STUPFEL M C6147
SUCHKOV A B C5976
SUCHKOV A B C5977
SUCOV E W C5978
SUGIYAMA F C6162
SULLIVAN B R C5293
SULTZ H A C6C98
SUNSHINE I C5979
SUTUGIN A G C598C
SUZDALEV I P C5981
SUZUKI S C55C8
SUZUKI Y C55C9
SWERDLOW M C6040
SWIFT P C5295
SWIFT P C5294
SWISHER S N C6099
SYMON K C61C0
SZARGAN P C5982
SZCZUREK Z C6C66
SZE M C C5312
SZEPESY L C5296

T

TABOURY F C575C
TABUCHI K C5198
TADA M C5297
TAKADA S C4979
TAKAHASHI I C5213
TAKAHASHI N C5CC5
TAKAHASHI A C5317
TAKAHASHI H C6063
TAKAICHI K C5256
TAKASHIMA Y C5983
TAKEDA N C6162
TAKEDA S C6116
TAKESHITA K C51C1
TAKEUCHI N C5510

TAKIMOTO J C6162
TALINA M C5984
TAMSMA A C6167
TAMURA Z C5298
TANAKA I C5299
TANAKA I C53C0
TANAKA K C53C1
TANAKA K C53C2
TANAKA M C6110
TANAKA S C5303
TANI T C5511
TANIMURA H C5575
TANIYAMA T C6148
TATEISHI R C6101
TATIYEVSKAYA Y P C5731
TAYLOR D C C6149
TEICHNER S J C5796
TELLER A C6236
TELLER A J C5305
TENG T L C6141
TENNEY M W C53C6
TEODORESCU C C5235
TEPLITSKII M G C5307
TEPPER F C53C8
TER HAAR G L C615C
TERABE M C5512
TERABE M C5514
TERABE M C5515
TERABE M C5513
TERABE M C5576
TERRY R A C61C2
TESKE W C53C9
THEODORE F W C5311
THEODORE L C5310
THODOS G C5747
THOMAS W J C5985
THORANDT K C5556
THORNTON J F C5312
TIBREA O C5036
TIEN P K C5919
TIFFANY W B C5986
TIKHONENKO A C C5194
TIMMINS R S C5642
TIMOFEYEV Y D C4985
TITOV N G C5313
TOMANEK A C5763
TONOMURA M C5577
TONOMURA M C5533
TONOMURA M C5581
TONOMURA M C4988
TOOS I C5314
TOPOROVA V V C5761
TORIYAMA N C5255
TOTH J C4939
TOWN J W C5987
TOYAMA T C61C3
TRACZYK K C61C4
TRANSTRUM L G C6131
TRAYSER D A C5315
TRESHOW M C6131
TRESHOW M C6151
TRESHOW M C6152
TRETYAKOVA L A C4932
TRIEFF N M C5516
TROFIMOV A I C5316
TROLINGER J D C5988
TSKHAKAYA V K C58C2
TSUDA M C5517
TSUJI K C5577
TSUJIMURA S C5317
TSUKAHARA M C5362
TSUKAHARA M C4918
TSUNEMOTO T C5101
TSUNETOSHI Y C6C63
TSYPIN A Z C4985
TUBBS L D C5480
TUBINA A Y C5518
TUERKOELMEZ S C5318
TUJI T C59C1
TURK A C5319
TURK A C5519
TURNBULL W T C5719
TUROWSKI P C5671
TUROWSKI P C567C

U

UDAVCAK R J C5482
UEDA H C5891
UEDA J C6162
UEDA K C6105
UENISHI G C5138
UHI K C552C
ULLAH U C5985
ULMER R C C5020
ULRICH W F C5926
UMLAND F C6174
UMLAND F C5578
UMSTEAD M E C5429
UMSTEAD M E C6007
UPMALIS A C5321
USPENSKIY N F C5761
UTHE E E C5602
UTHE E E C5521
UWAMINO G C6166
UWANISHI G C5139
UWANISHI G C5141
UWANISHI G C514C

V

VADOT L C5628
VADOT L C5629
VAILLANT G C6238
VAL DBERG A Y C5322
VALKO P C5623
VALLEE R E C5798
VAN DER DRIFT J C5323
VAN GEUNS H A C6034

VAN LEEUWEN P C6034
VAN LIER C C6017
VARLAMOV M L C5989
VARLAMOV M L C5324
VARSHAVSKIY I L C5325
VARSHAVSKII T P C5358
VASAK V C5522
VASILIEVA E V C5990
VASTOLA F J C5284
VEKENY H C5523
VENDRAMINI R C4989
VESTAL M L C5326
VIETH W R C5879
VIETH W R C5883
VIGNES M C5991
VINNIK I Y C4997
VOGELSBERGER W C5261
VOGELY W A C4990
VOGL M C6119
VON HALLE E C5751
VON HALLE E C6177
VOROBEV O O C5327
VOSOLSOBE J C5812

W

WADA A C5328
WAGMAN J C4948
WAGNER T O C5329
WAGNER T O C4991
WAHL F C5478
WAHNSCHAFFE E C5524
WAHNSCHAFFE E C5330
WAL J F VAN DER C5331
WALDBOTT C L C6106
WALKER A B C6200
WALKER P L JR C5284
WALL H JR C4921
WARD A L C5824
WARD T V C5589
WARNICK P C5332
WATANABE A C5526
WATANABE T C5198
WATANABE Y C4940
WATSON J T R C5992
WEATHERLEY M L P M C5579
WEAVER E E C5333
WEAVER G M C6121
WEAVER G M C6153
WEAVER N K C6201
WEBER E C5993
WEBER E C5334
WEBSTER F X C5900
WEHMEIER W C5335
WEIDMANN H C5084
WEINECK H C5335
WEINROTTER F C5257
WEIR J B D V C6026
WEIS J C5817
WEISER M C6146
WEISS H S C6032
WELGE K H C5797
WELLER A E C5315
WELLER S C5336
WELSH F E C5860
WEN C Y C5854
WENG T C6107
WENTZEL K F C6154
WEST P W C5430
WESTPHAL J C5564
WESTPHAL J C5562
WETHERN J D C5994
WHITAKER S C5995
WHITBY K T C5527
WHITE F T M C5364
WHITE G C6272
WHITMAN W G C5996
WHITMAN W G C5855
WHITTAKER C W C5997
WICKERT K C5337
WICKERT K C5528
WIEDER I C5998
WIEGANDT H F C5999
WIELAND K C6000
WIJK A V D C5708
WIKSTROM L L C4981
WILKEN C H C5574
WILLET H P C5338
WILLIAMS D C5480
WILLIAMS D C5419
WILLIAMS H D C6001
WILLIAMSON D C5339
WILSON D J C6002
WILSON E B C5020
WILSON K W C5529
WIMMER D B C5154
WINDE H C5769
WINEGARDNER J D C5530
WINFIELD T W C5490
WINKLER H C534C
WINKLER P C5359
WINKLER P C5633
WINTER E R S C6003
WINTER R M C5341
WIRTZ K C6004
WISE H F C6239
WISTING W L C5342
WITHORN B C5343
WLODARSKI R C5829
WOEHLER L C6005
WOLF H C5344
WOLFE C L C4984
WOLFF R W C5472
WOLFSON B T C5531
WOLOWSKI E C5345
WON W D C6108
WOOD O R C6006
WOODRUFF P H C5346

WCODS F J C6007
WCOLF A R C5420
WCOMERT D E C5532
WCSTMANN B S C6087
WCYNA H C5345
WRIGHT R H C4973
WRIGHT R C5868
WRIGHT W R C6175
WRIGHT W R C5348
WYNDER E L C5417
WYRICK D D C5830

Y

YAGI S C5349
YAGODKIN V I C5695
YAGODKIN V I C5134
YAGUCHI S C61C9
YAKOVLEV V V C6018
YAMADA H C6162
YAMADA S C4979
YAMADA T C5350
YAMAGA S C611C
YAMAGIWA H C6116
YAMAMOTO A C5110
YAMAMOTO A C5352
YAMAMOTO T C5078
YAMAMOTO T C5351
YAMAMOTO K C5207
YAMANE Y C4993
YAMATE N C5533
YAMATE N C5581
YAMATE N C5580
YAMATE N C5534
YAMATE N C5577
YAMATE N C5582
YAMATE N C6008
YARDLEY J T C6009
YASUDA K C5123
YELISEYEV V S C5630
YERMOLENKO N F C6010
YERMOLENKO Y N C6010
YOCOM J E C5553
YOKOYAMA E C6112
YOKOYAMA E C6111
YONEDA T C5143
YOSHIDA H C6011
YOSHIDA K C6081
YOSHIDA R C6115
YOSHIDA R C6114
YOSHIDA R C6113
YOSHIDA T C5140
YOSHIDA T C5141
YOSHII M C6116
YOUNG G J C5353
YOUNG R A C6012
YOUNG R A C6013
YOURT G R C5354
YU M H C6155
YUKHNOVETS Y D C5358
YUN K S C5894
YUR EVA T M C6014
YUU S C5421

Z

ZABRANSKY M C5812
ZABRODSKIY S S C5645
ZAIKO V P C4995
ZALMAN S C5355
ZAMBONIN, P G C6015
ZAMOCHNICK S B C5928
ZAMPOL SKAYA L M C5989
ZAMPOL SKAYA L M C5324
ZARKER K E C5073
ZAWADZKI E A C5356
ZAYTSEV M M C5322
ZDUNKOWSKI W G C5631
ZEILINGER J E C6016
ZEL VENSKIY Y D C5133
ZERNIKE F C6017
ZHABROVA G M C5981
ZHDANOV A K C6018
ZHUKOV N A C5358
ZHUMATOV KH ZH C6065
ZIELINSKI E C5535
ZIGAN F C5671
ZIGAN F C5670
ZIMIN E P C6019
ZIMMERMANN F K C6020
ZIMMERMANN F J C6021
ZIMON A D C6022
ZIMON A D C6023
ZINN R E C6202
ZIZKA J C5357
ZLATIN L E C5358
ZOLAR Y C5246
ZOLLER W H C5555
ZOLOTAREVSKIY L S C5325
ZOLOTAREV W S C5638
ZOLOTAREV V S C6024
ZOLOTUKHIN A N C6117
ZUEV V E C5536
ZUK W C6025
ZUMER M C5701
ZUR MUEHLEN T C5583
ZURICH R T C4994
ZURLO N C5632